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PRECISION CASTING on a Mass Production Basis

By CHARLES O. HERB

TWENTY-FIVE million buckets for aircraft superchargers were precision-cast by the lost-wax or investment-mold process at the plant of the Haynes Stellite Co., Kokomo, Ind., during World War II. In addition, many other parts essential to the successful prosecution of the conflict were manufactured by the same method. Many of these parts, of intricate design and extremely thin cross-sections, had to withstand operating temperatures as high as 1500 degrees F.

Because of the knowledge gained in wartime precision-casting operations and in the development of high-temperature resisting alloys, the concern recognized the great potentialities of precision-cast products for peacetime use. To meet the anticipated demands, it has constructed a new building which will be devoted entirely to precision casting. Operations in the new plant will be described in this article.

Before starting the description of operations, it would be desirable to point out some of the advantages of precision casting. By this process, parts can be readily produced that are of such an involved design or possess such intricate details that they could not be forged or machined in one piece, or if they could be so produced, it would only be after many operations. One part that formerly required forty-two separate machine shop operations, a heat-treatment, and four grinding operations is now produced with all dimensions cast to size within a few thousandths inch, and only four grinding operations. Trailing edges on such parts as compressor blades for airplane jet engines are cast with sections as thin as 0.012 inch. Turbine

Fig. 1. Variety of Precision Castings which have been Produced in the New Plant of the Haynes Stellite Co. from Stellite, Hastelloys, and Various Stainless Steels. Some of These Castings Must Operate Successfully at Temperatures as High as 1500 Degrees F.

blades, of intricate airfoil contours, must operate without possibility of failure at the high temperature of 1500 degrees F.

The Haynes Stellite Co. believes that tolerances cannot be commercially held at the present time closer than plus or minus 0.003 inch. It is advisable to cast to size the profiles of a part or other surfaces difficult to finish by grinding rather than to specify close tolerances for the dimensions of bearing holes or flat surfaces that could readily be ground or lapped to meet assembly requirements.

The fact that precision castings have such a high degree of finish and accuracy of shape and size that they can be used without any machining in many instances, and with a minimum of machining in the remainder, is also, of course, one of their prime advantages. Still another important advantage is derived from the fact that precision castings can be readily made from high-strength heat-resisting alloys, some of which could not be forged or otherwise produced in intricate or unusual shapes. Some of these alloys have melting points as high as 2600 degrees F. The higher cost of precision castings is compensated for by the elimination of machining operations.

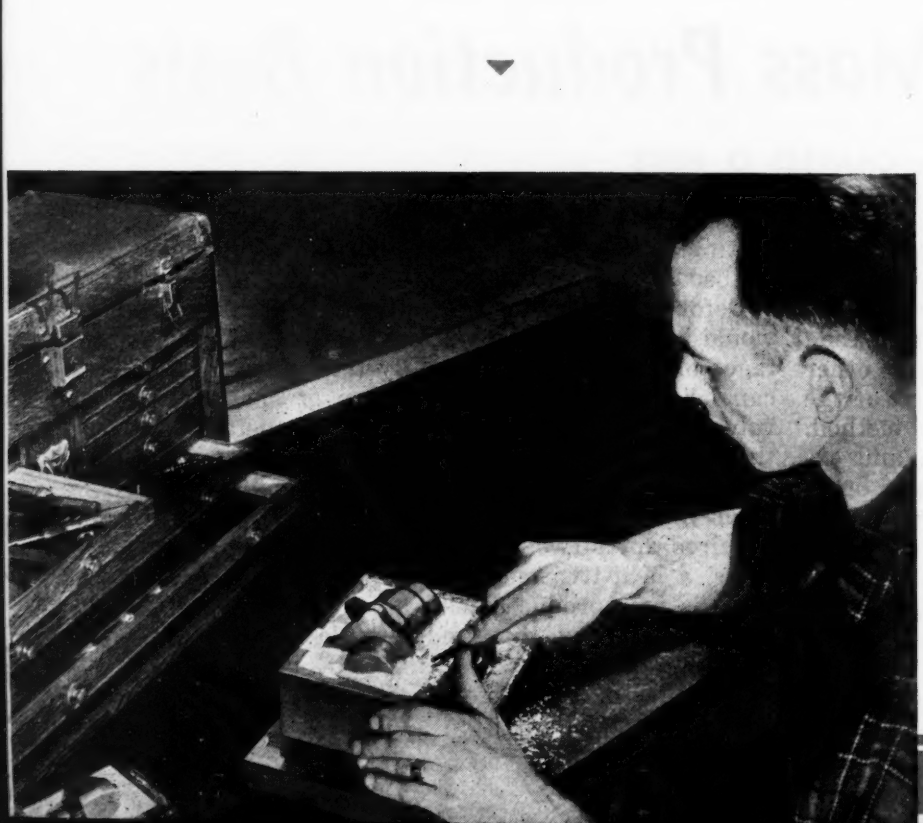


Fig. 2. In Order to Produce the First Half of the White-metal Dies Required for Making the Wax Patterns, a Portion of the Master Pattern is Embedded in Plaster

Typical precision castings so far made by the concern from Stellite, Hastelloys, and various stainless steels are illustrated in Fig. 1. The largest precision casting so far made on a production basis weighs 3 pounds. Some of these precision castings have a much longer life than similar parts that were formerly produced from tool steel at considerably greater cost.

The first step in precision casting is the preparation of one or more master patterns, which are replicas of the parts to be cast except that they are made over size in all dimensions from 1 1/2 to 2 per cent. This over-size allowance compensates for shrinkage of the wax pattern and the metal poured to form the part. The master pattern is made of steel, brass, Stellite, wood, and other materials. When the pattern has been finished, it is carefully checked to make certain that all dimensions correspond with blueprint specifications. The next step in the precision-casting process is to cast a die of white metal around the master pattern. For such dies, a metal composed of 40 per cent tin and 60 per cent bismuth is used. Such a white-metal alloy has a melting temperature of 375 degrees F., and is usually poured at around 400 degrees F. From one to twenty-four cavities are generally made in these dies, the number depending on the size of the part. This practice is followed because it is desirable to produce as many wax patterns per injection and castings per investment mold as is practical.

The first half of a die is produced with approximately half the master pattern embedded in plaster, as shown in Fig. 2.

Fig. 3. Preparing to Pour Molten White Metal to Form Half of a Wax-pattern Making Die. Air Pressure is Applied on Top of the Poured Metal

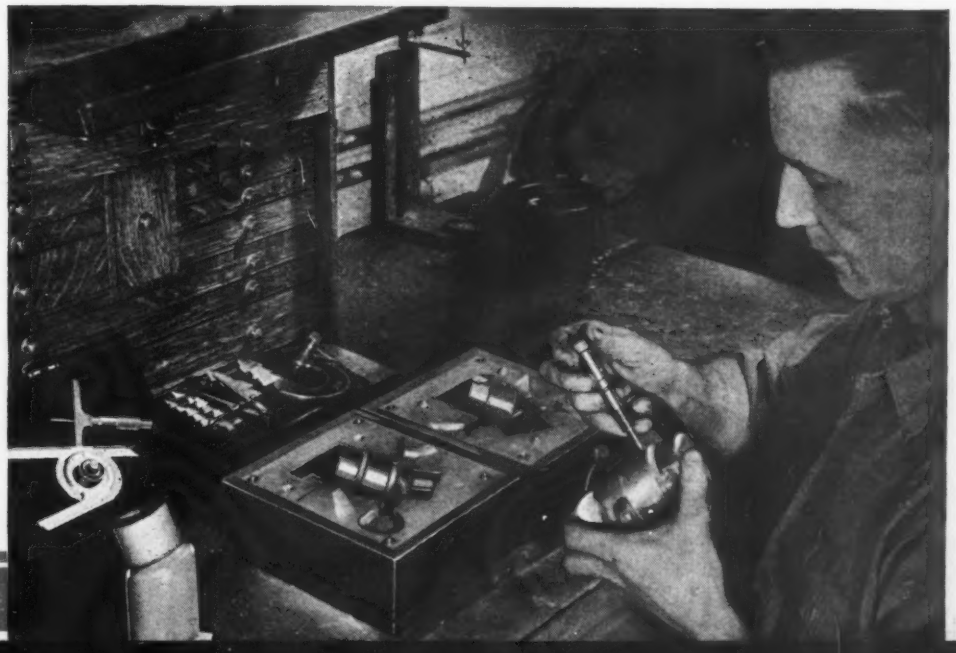
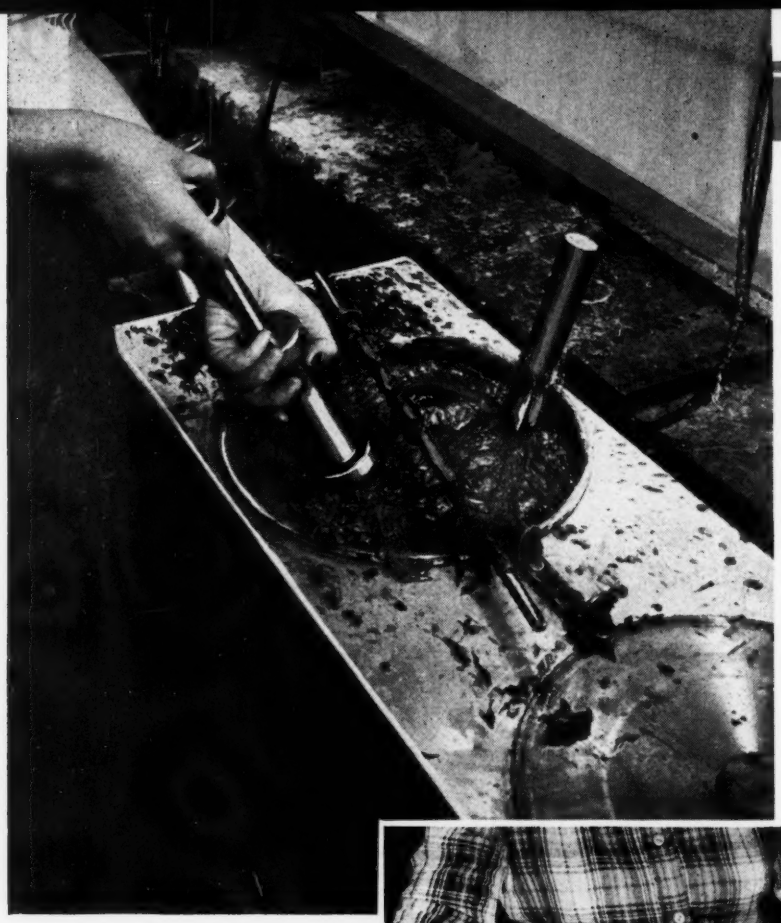


Fig. 4. Two Halves of a White-metal Die of the Type Used in Producing Wax Patterns, together with the Master Pattern Used in Making the Dies



Metal is poured into the flask after it has been set up on the table of a machine such as illustrated in Fig. 3. In this illustration, the diemaker is preparing to pour the molten white metal into the die flask through a gate in the flask cover. When one half of the die has been poured and solidified, the plaster is removed from around the master pattern and the second half of the die is poured with the master pattern embedded in the metal of the die half already completed. When both die halves have been produced, the pattern is, of course, removed. Typical die halves, together with the master pattern used in their production, are shown in Fig. 4.

The next step is to produce wax patterns from the white-metal dies. Wax is melted to the consistency of paste in elec-

Fig. 5. (Above) Drawing Wax from an Electrically Heated Pot into a Grease Gun preparatory to Forcing the Wax into the Impressions of a White-metal Die

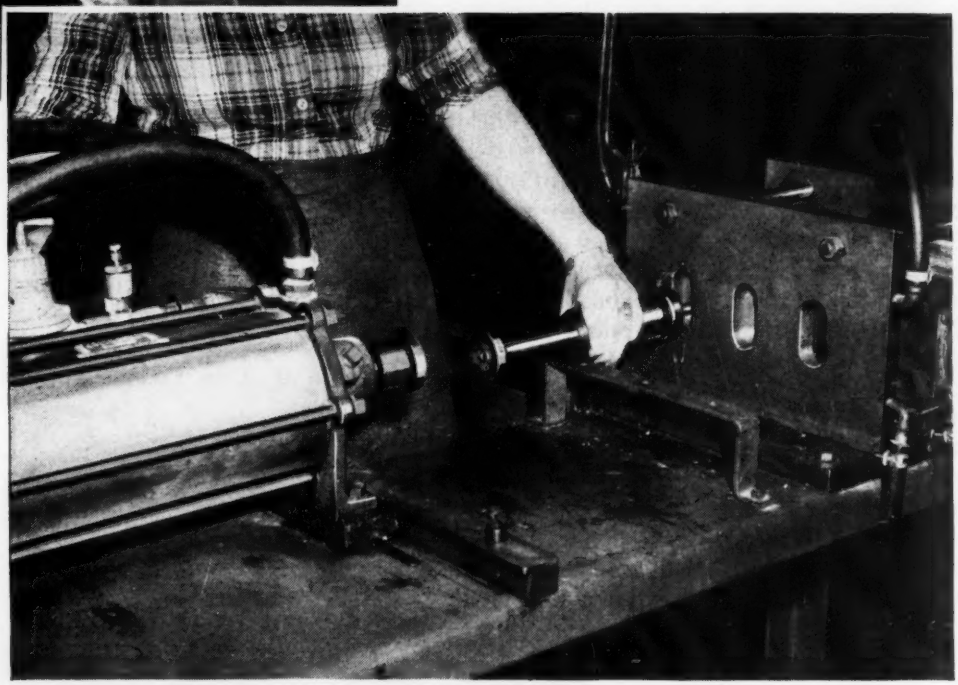
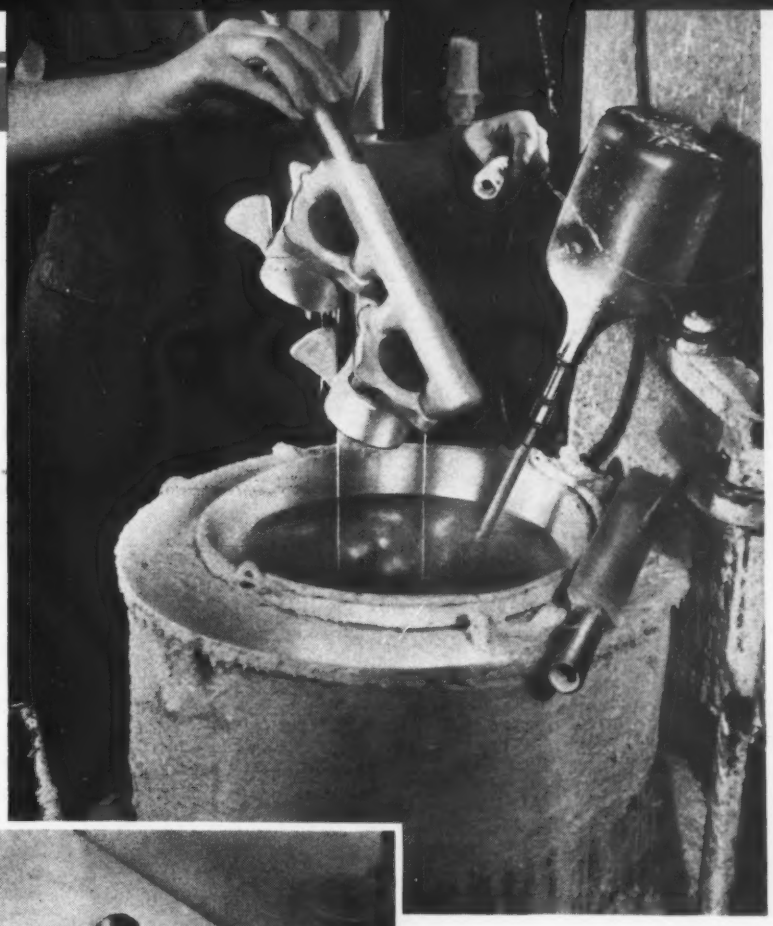


Fig. 6. (Right) The Wax is Forced into the White-metal Dies by the Ram of a Pneumatic Cylinder, Arranged Horizontally, as Shown, or Vertically

Fig. 7. Removing from a White-metal Die a Wax Pattern that will be Used to Produce the Investment Mold Required in Making a Precision Casting

trically heated pots, and withdrawn from these pots by means of hand grease guns in the manner shown in Fig. 5. The gun is then transferred to a simple vise of either horizontal or vertical design for forcing the wax into the cavities of a die that has been mounted on the machine. Any necessary cores have first been assembled in the die. These cores are customarily made of brass or stainless steel.

The nozzle of the wax gun is inserted in the gate of the die, the end of the plunger being in contact with the ram of a pneumatic cylinder, as seen in Fig. 6. When the ram is actuated, the wax is forced solidly into all the impressions of the die cavity, no matter how fine or intricate they may be. A pressure of 20 pounds per square inch is applied in forcing the wax into the dies.



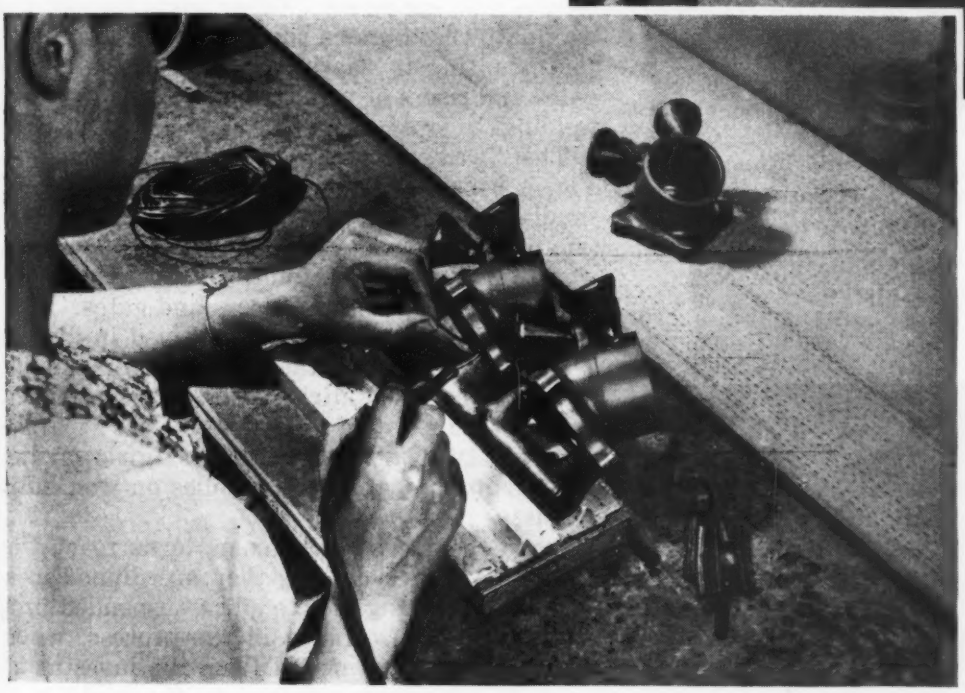


Fig. 8. (Left) One or More Wax Patterns are Assembled to a Wax Gate Casting, and a Number of Risers are Attached to the Patterns

Fig. 9. (Above) The Wax Pattern is Dipped into a Mixture Containing Suspended Silica, which Leaves a Coating on Mold Surfaces, Insuring a Smooth Finish on the Castings

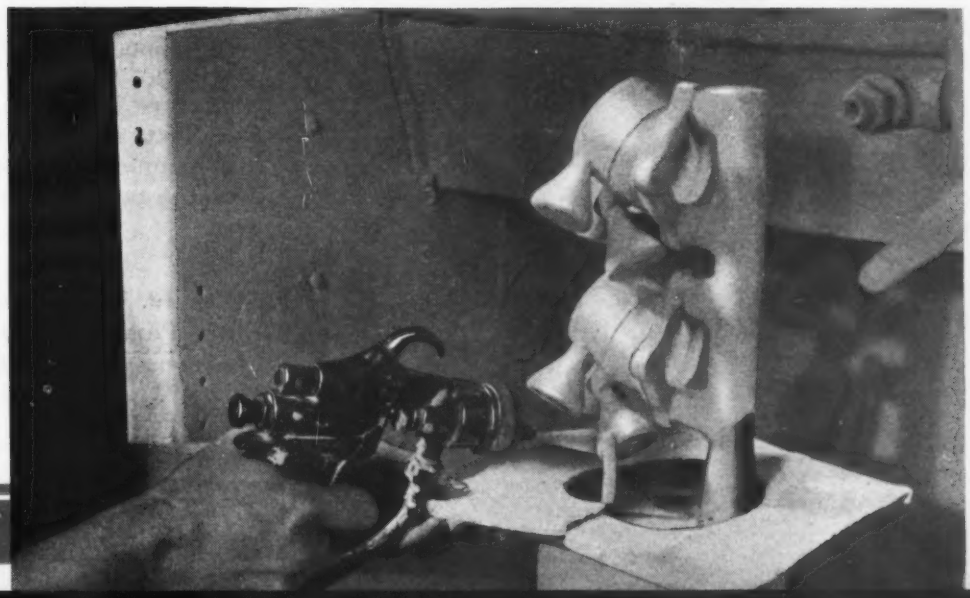


Fig. 10. Spraying Silica with an Air Gun on the Portion of a Wax Pattern Assembly that did Not Become Coated in the Dipping Operation

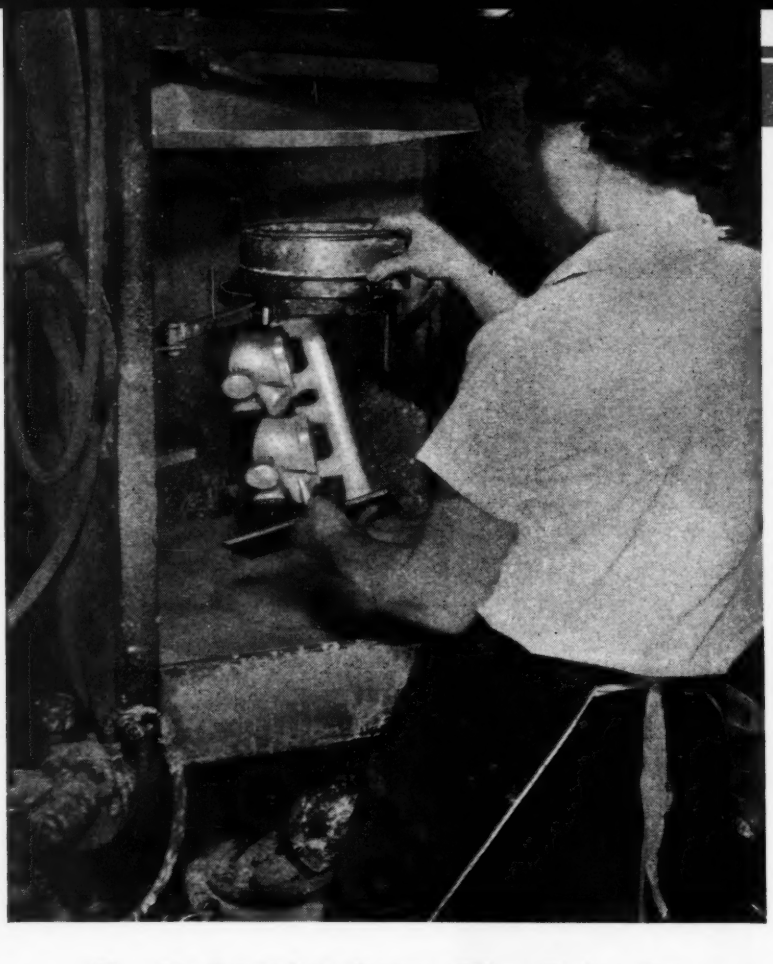


Fig. 11. Somewhat Coarser Silica Grains than Those Applied in the Dipping and Spraying Operations are Screened on the Pattern to Give a "Stuccoed" Coating that will Adhere Readily to the Investment Mold Material

The wax used in making the patterns is blended in the plant. One wax, dyed greenish blue, is used for most patterns. However, where patterns have extremely thin edges, as in the case of turbine blades, a wax of light brown color is employed which can be readily forced into deep narrow die cavities and will maintain thin edges if the patterns are carefully handled. As this wax is more brittle than the greenish-blue wax, it is used only when necessary. The pots in which the wax is melted are held at a temperature of approximately 140 degrees F.

Immediately after the dies have been removed from the vises, they are taken apart and the wax patterns removed, as indicated in Fig. 7. The wax patterns are replicas of the master patterns, except that they have thin flash fins, cores, and gates that must be removed. For this work, the wax patterns are placed on fabric belt conveyors, as shown in the heading illustration. Girls along this line clean off the fins, cores, etc. Other girls inspect the wax patterns to make sure that they are ready for mounting in flasks, and still others attach gates and risers of wax to the patterns by "wax welding."

The "wax welding" process, as shown in Fig. 8, consists of melting wax, in the form of small-diameter wire, by means of a hand electric heating device and allowing the molten wax to flow along the joints between the original wax pattern and the risers and gates. Both the risers and gates are also formed in dies in a similar manner to that followed in making the patterns. The girl in Fig. 8 has attached a wax casting with four gates and six separate risers to two patterns. The last girls on the line mount the pattern assemblies on wax hubs or bases.

When the assembled wax patterns reach the end of the conveyor line, they are dipped in a mixture consisting of fine silica suspended in a suitable medium. Later in the process, when the wax pattern is melted from the investment mold, this mixture adheres to the mold surfaces against which the metal is cast and insures smooth finish on the castings. The operation of dipping a wax pattern in the silica mixture is illustrated in Fig. 9.

Next, the pouring end of the wax assembly is mounted on a steel baseplate. The small area of the pattern that was not coated in the dip-

Fig. 12. The "Stuccoed" Wax Pattern Assemblies are Passed through a Dehumidifying Tunnel on a Conveyor Belt, This Drying Process Requiring about Twenty-two Minutes

ping process is sprayed with the silica mixture by means of an air gun, as shown in Fig. 10. Somewhat coarser grits of silica are then shaken on the pattern with a screen, as seen in Fig. 11, so as to provide a substantial coating which will readily adhere later to the investment mold.

The "stuccoed" assembly is now passed through a heated dehumidifying tunnel on a conveyor belt, as illustrated in Fig. 12, to insure rapid and complete drying of the assembly. The passage through the tunnel takes twenty-two minutes. When the assemblies leave this tunnel, they are placed in a small flask of sheet Hastelloy C, shaped like a stove pipe, around which wax paper is wrapped so that it extends beyond the top of the flask. The pattern base is then sealed to the flask and paper by melting wax around the joint, so as to make the flask liquid-tight. This operation is shown in Fig. 13. The excess paper above the flask serves to retain surplus investment material until it can be removed.

The flask with the assembled wax paper is then carried by conveyor to an adjoining room, where it is filled with a chemically hardening investment material. This consists mainly of silica, which is available in various grits from flour to coarse sand. Ethyl silicate is mixed with the powders to act as a binder. The investment material is blended on the second floor of the building and fed to the mixing machines through overhead hoppers. As the flasks reach the mixing machines, the investment material is ladled into them in the manner illustrated in Fig. 14.

The filled flasks are next placed on vibrating tables or shakers which results in packing the investment material tightly around the wax assembly. This operation, which is performed on equipment such as shown in Fig. 15, also insures the elimination of all air from the molds. After approximately one hour, the investment material has set and all liquid and finer material has risen to the top of the flask and attained a jelly-like consistency. The excess material is then cut off on a hacksawing machine, after which the mold is allowed to age for several hours.

At the end of this period, the molds are delivered to a battery of gas-fired furnaces, about 60 feet in length, in which they are placed upside down, as shown in Fig. 16, and gradually pushed from the loading end to the discharge end by the operation of a horizontal pneumatic cylinder. Gas burners located in the far half of the furnace maintain a temperature ranging from 1300 to 1900 degrees F., depending upon the characteristics of the part to be produced in the molds. High temperatures harden the investment

Fig. 13. As Each Wax Assembly Reaches the End of the Dehumidifying Tunnel, a Flask of Hastelloy is Sealed to the Steel Base with Wax to Make Sure that the Assembly will be Liquid-tight. A Wax-paper Roll Surrounds the Flask

Fig. 14. Filling a Flask with Chemically Hardening Investment Material Directly from a Machine in which the Investment Material is Mixed. The Material is Available in Various Grits

Fig. 15. After the Flasks have been Filled with the Investment Mixture, They are Placed on Vibrating Tables for Packing the Investment Material Tightly around the Wax Pattern and Eliminating All Air from the Molds. This Step Takes Approximately One Hour

Fig. 16. The Completed Molds with the Wax Patterns Encased are Passed through Long Furnaces for the Double Purpose of Burning out the Wax and Hardening the Investment Material. The Molds are Placed upside down to Permit the Molten Wax to Run Out

material to the degree necessary to insure successful precision casting.

The heat from the fired portion of the furnace passes toward the loading end and ignites the wax patterns in the molds so that the wax flows downward out of the molds. All residue is also burned from the mold cavities. It is of vital importance that no pattern residue be left in the mold cavities; plastic patterns used in this plant proved unsatisfactory because of the difficulty of removing all residue. The heating cycle lasts several hours. Fig. 17 shows the loading end of a furnace with flames rising from the flasks.

At the unloading ends of the furnaces are batteries of small indirect-arc furnaces in which accurately weighed charges of the alloy for each casting are melted. These furnaces have a capacity for about eight pounds of metal each. They are charged with short 1/2-inch diameter rods of the proper metallurgical analysis. This raw material is segregated according to heats. From five to ten minutes is required for a charge to reach the pouring stage.

The hot baked molds are clamped directly over the pouring spout of the melting furnaces, in the manner illustrated in Fig. 18, after the metal to be poured has attained the proper temperature, as determined by means of an optical pyrometer. Then the entire furnace pot is inverted to permit the molten metal to flow into the investment mold. When the mold has been filled, air pressure of from 3 to 4 pounds per square inch is applied on top of the metal to insure that it will flow into the most minute mold impression, as required for casting thin edges and for producing sound, dense castings.

The grain size of the castings can be governed by controlling the temperature of the mold and metal within close predetermined limits. For example, the hotter the mold, the more time for grain growth and the larger the grain in the castings.

Conversely, the cooler the mold, the finer the grain.

After the metal has been poured, the mold is allowed to cool slowly and in about four hours, the casting, together with its gates and risers, is knocked from the mold under a pneumatic hammer of the type shown in Fig. 19. The casting is then placed on a conveyor which carries it to a department in which the gates and risers are cut off by machines equipped with rubber-bonded wheels. Next the castings are shot-blasted, after which they are subjected to a rough inspection, and any castings with obvious defects are rejected at this time. Castings that pass the rough inspection are sent to the grinding department, where the gate areas are smoothed and surface irregularities are removed. The castings are then sand-blasted to obtain a good finish, after which they are returned to the inspection department for complete visual and dimensional checking.

All castings that pass this inspection are immersed in a Zyglo bath, which consists of a fluorescent penetrative oil that reveals cracks or other surface imperfections in non-magnetic materials. Finally, every casting is X-rayed to make certain that there are no internal defects, and the films are filed for future reference. X-ray equipment of 250,000 volts has been installed in a special lead-lined booth, as seen in Fig. 20, for performing X-ray operations on a quantity production basis.

Tensile tests for castings that must render satisfactory service at high temperatures are conducted on specimen blanks with the parts heated to those temperatures. For this operation, the specimens are heated to the required temperature, say 1500 degrees F., in small electric furnaces mounted on a stand adjacent to the physical testing machine. These furnaces, with the specimen inside, are transferred, one at a time, into line with

Fig. 17. View of Loading End of One of the Furnaces, Showing the Flames from the Burning Wax Rising to the Roof of the Furnace. The Molds are Heated to from 1300 to 1900 Degrees F.

Fig. 18. The Hot Investment Molds are Clamped to the Pot Type Melting Furnaces and the Entire Assembly is Inverted to Permit the Molten Metal to Flow into the Investment Molds. Air Pressure is Then Applied on the Poured Metal to Insure a Sound, Dense Casting

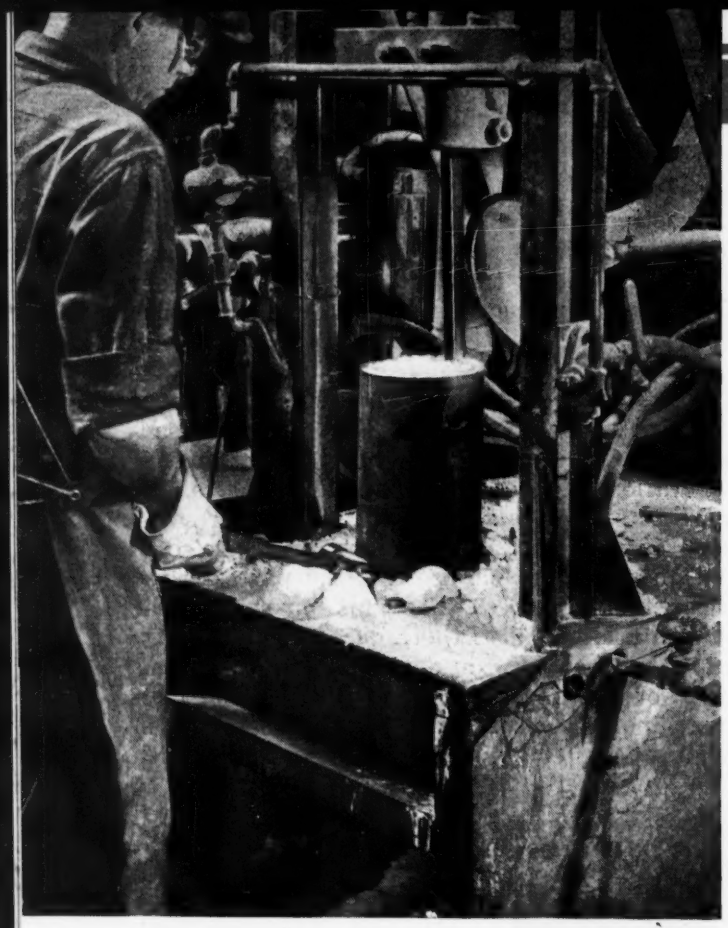


Fig. 19. After the Castings have Cooled for About Four Hours, They are Knocked from the Investment Mold under Pneumatic Hammers of the Design Here Illustrated

the pulling ram of the testing machine, so that the specimen is completely enclosed in the furnace while the test is actually performed.

While the largest casting so far made by the Haynes Stellite Co. weighed 3 pounds, castings weighing as much as 5 pounds can be regularly produced with the pressure casting furnaces. As a matter of fact, with the conventional gravity pouring method, there is no weight limitation. Certainly there seems to be no minimum weight limitation, within reason, because a number of parts have been cast that weighed only 0.002 pound—500 pieces to the pound. At present, the longest dimension in any one direction that has been produced is 7 or 8 inches.

The precision-casting process has opened a new era for the design engineer in that he may now use alloys that were not previously available to him because they could not readily be made into desired shapes. Furthermore, he is not limited to designs that can be made only by conventional methods, since precision casting has opened up a way of producing intricate contours and shapes which were not hitherto practical on a production basis. Precision castings have played a big part in the development of gas turbines, and will continue to do so.

Government by Emergency

Since the early 1930's, we have been experimenting with "Government by Emergency," and from that time to this we have never been free from emergency. First, there was the emergency of the depression. Next, the emergency of unemployment and recovery with the N.R.A., followed by the Wagner Act. Next came the war emergency. And now we have the emergency of reconversion. Under the plea of protecting the public interest in emergencies, we have made rapid and accelerating progress away from the safeguards and the orderly procedure of our Constitution. We have seen the growth of the practice of having the same Government authority act as prosecutor, judge, and jury, and the denial of judicial review of decisions thus made, such as those made by the National Labor Relations Board.—*Lawrence B. Morris before the Pressed Metal Institute*

Fig. 20. Trays of Precision Castings are Passed through the Automatic X-ray Equipment for Obtaining a Quality Check on a Real Quantity Production Basis. All Films are Filed for Future Reference

The Technique of Metal Spinning

Construction of Forms; Tools Used; Shapes and Materials that Can be Spun; and Size Limitations of the Spinning Process

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METAL spinning is not a new art. History records that it goes way back to the time of the Egyptians, but it is only within the last twenty-five years that this process has been applied extensively for industrial purposes. When metal spinning was introduced into this country about 1840, it was used almost exclusively for the production of fine gold, silver, and pewter hollowware and chalices. By the end of the century, it was being used for making chandelier parts and cooking utensils. As late as World War I, only soft non-ferrous metals were formed by this art. Since 1920, and especially during World War II, great strides have been made in metal spinning and its application has been broadened considerably. Tougher materials, heavier gages, and larger diameters have been spun.

In the past, the methods employed in spinning and the applications of the process have been kept secret; however, wide publicity is now being given to them by the spinning industry itself. Modern methods of spinning were described in an article published in November MACHINERY. More detailed information concerning the shapes and materials that can be spun and size limitations will be discussed here.

The tolerances obtained on a spun-metal shape depend to a large extent on the workmanship and quality of the form used. The form is generally constructed of carefully selected and cured kiln-dried hard maple in strips 1 inch thick. These strips are laminated and glued together with the grain of alternate strips running in opposed directions. The pieces thus formed are then turned on a lathe to the shape desired. Steel forms, however, are used when large quantities of parts are to be made, where an extremely smooth inside surface is desired, or when exacting tolerances are required. Split or sectional forms may also be needed for spun shapes having a turn-under or re-entrant shape, in order to permit taking the form apart in sections after the shell has been spun over it.

Simple, shallow spun shapes require only one form, called a "standard" form, which is made the same size as the finished product. For deeper and more intricate spun shapes a series of forms is needed, over which the metal is progressively spun. Knowledge as to the quantity and shape of these progressive or "breakdown" forms can be obtained only by cut-and-try methods or by a study of similar jobs that have been successfully spun.

A follower, usually a block of wood, is used to hold the metal blank against the spinning form. Followers are made to suit the shape of the form, utilizing the largest possible bearing surface on the work. When a follower with a small bearing sur-

Fig. 1. Spinner Using a Common Blunt-edged, Rod Form Tool by Means of which the Metal is Caused to Flow over the Form

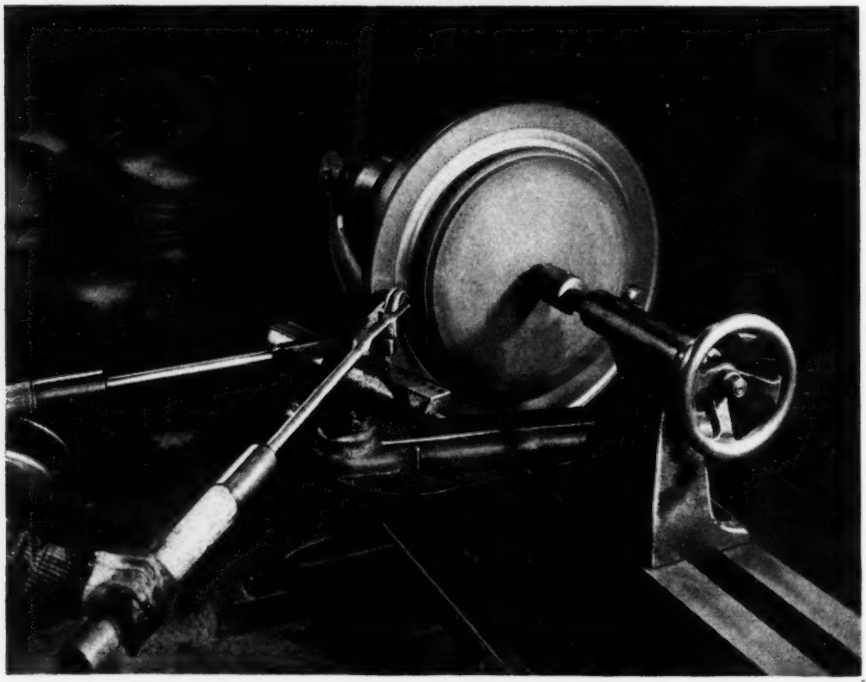


Fig. 2. "Scissors" Type of Tool for Spinning Heavy-gage Metals. This Tool has a Changeable Fulcrum to Provide Maximum Leverage

face is necessary, it is sometimes advantageous to cover the face of the follower with emery cloth to prevent slipping. Followers are centered on one end to take the tail-center of the spinning lathe.

The craftsman, commonly called the "spinner," exerts pressure on a long, blunt-ended tool which he deftly controls with his arms, hands, and body, causing the metal to flow over the form, as shown in Fig. 1. Spinning tools for aluminum, brass, copper, or silver are usually forged to the desired shape from tool steel, and the working end is hardened and polished. Some spinning tools, instead of being forged, have detachable heads which are screwed into the tool shanks. Aluminum bronzes in rod form, containing approximately 90 per cent copper, 8 per cent aluminum, and 2 per cent iron, make satisfactory tools for spinning iron, tinned-iron, steel, or stainless steel.

The tools for spinning are, of necessity, made in a large variety of shapes, usually 2 feet long and fitted into a wooden handle, approximately 18 inches long. There are tools for beading, burnishing, flattening, grooving, smoothing, inside flaring, "ring-off," etc. Individual spinners usually have their own variations of tools and spinning methods.

On heavy-gage materials, a lever or "scissors" type tool is used. This tool has a changeable fulcrum to provide maximum leverage, as illustrated in Fig. 2. This type of tool usually has a "roller" of highly polished tool steel which revolves by direct contact with the work.

The shape of a part to be spun is often controlled by the size and gage of the material. However, to be adaptable to spinning, an article must generally be concentric or round. It may be a straight cylinder with the same diameter throughout, hemi-

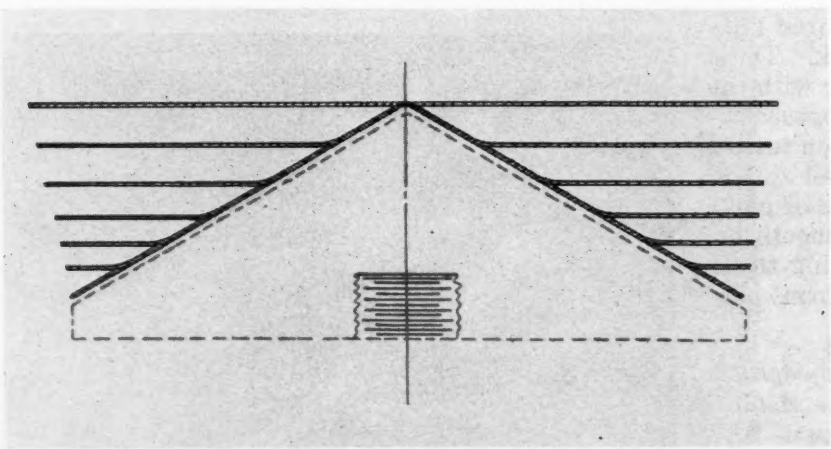


Fig. 3. Various Steps in Forming a Conical Shape by the Spinning Process

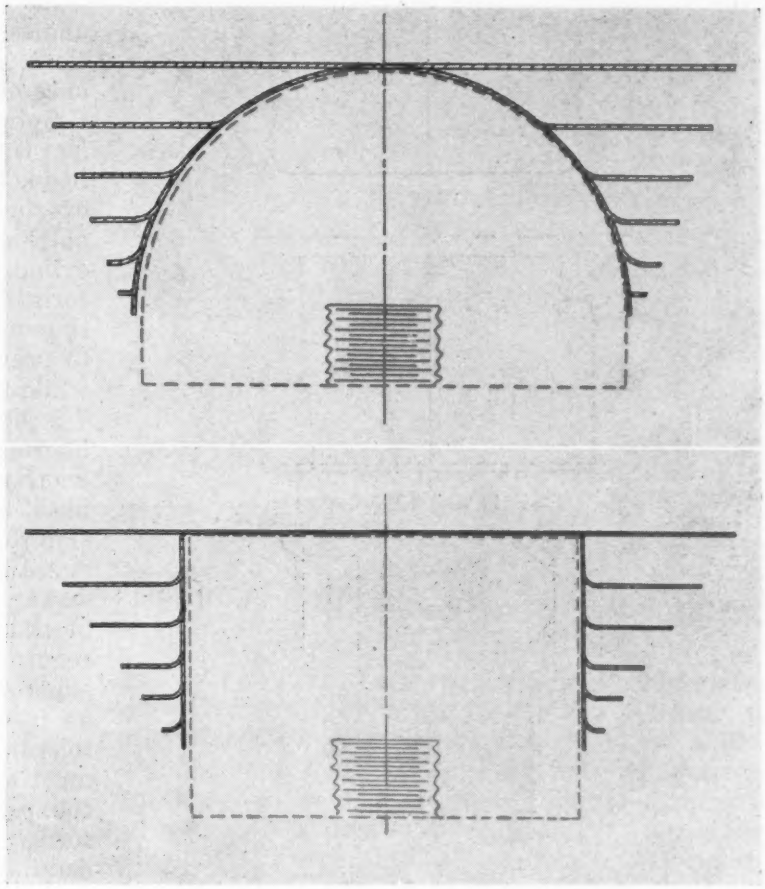


Fig. 4. (Above) The Forming of a Hemispherical Shape. Fig. 5. (Below) Steps in Spinning a Straight-sided Cylinder

spherical, conical, a partial circle, or any segment of a circle. Oval spinning is possible, but often impractical and costly. It is also possible to spin concentric details into any part of a square or rectangular sheet, provided clearance can be obtained for the maximum hypotenuse in the blank.

The cone is the easiest shape to form by metal spinning; consequently, it is the most economical. This is due to the fact that the metal blank is not subjected to severe strains when worked on a conical spinning form, as shown in Fig. 3. The hemispherical shape is more difficult to spin than the cone. From Fig. 4, it can be seen that the first three "spin downs" have gradual angles and are relatively easy. However, the angles grow increasingly sharper and the spinning more difficult as the metal is forced farther back on the form.

A straight-sided cylinder, such as shown in Fig. 5, cannot be produced as economically by metal spinning as the hemisphere, cone, or truncated cone. In spinning a sharp angle, the metal is exposed to great strain, and more time and skill are required to hold the part being spun to accurate tolerances. A cylinder, such as that shown in Fig. 5, and even articles with numerous right angles, can be spun successfully; but the avoidance of sharp

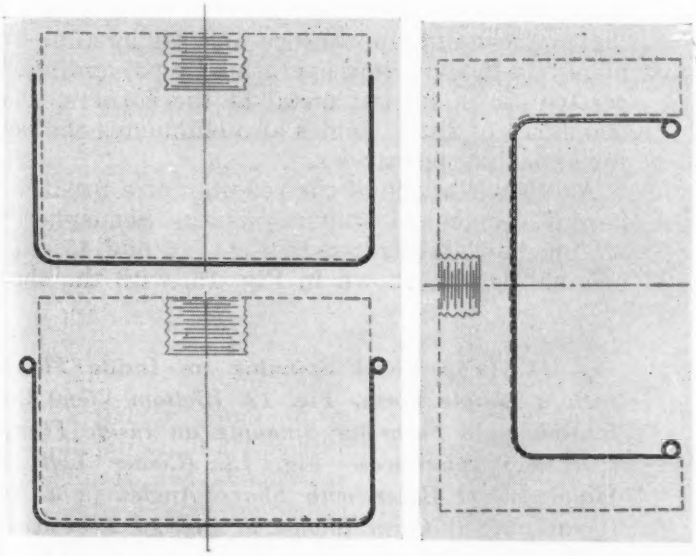


Fig. 6. (Above Left) Cylindrical Shape Spun over a Standard Spinning Form. Fig. 7. (Below Left) Forming an Outside Bead on the Cylindrical Shape. Fig. 8. (Right) Inside Bead Requires Second Form

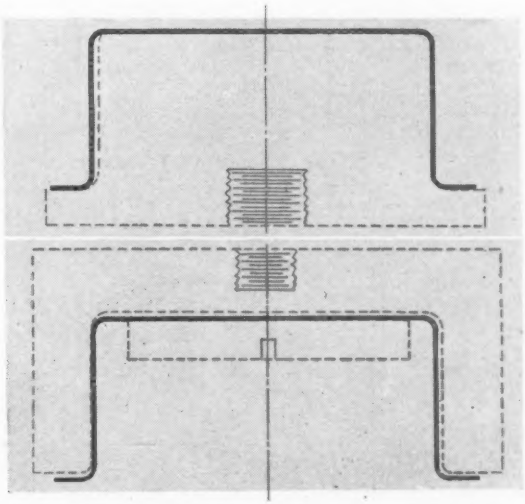
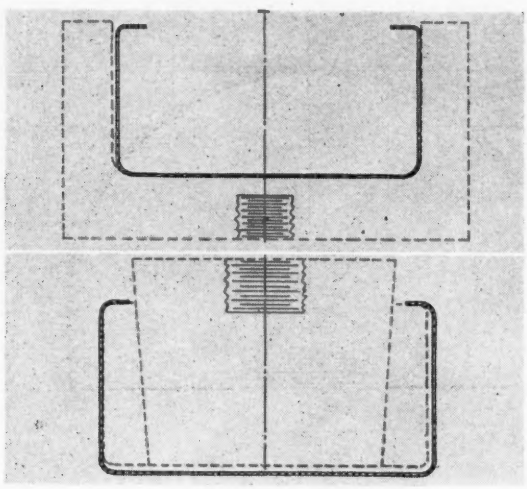
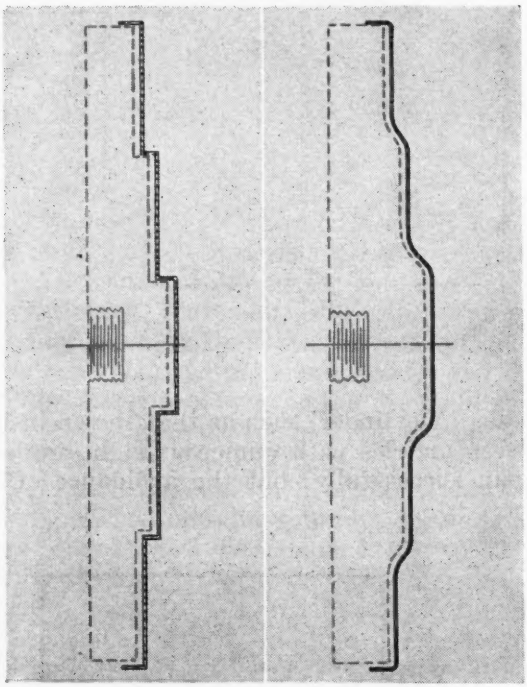


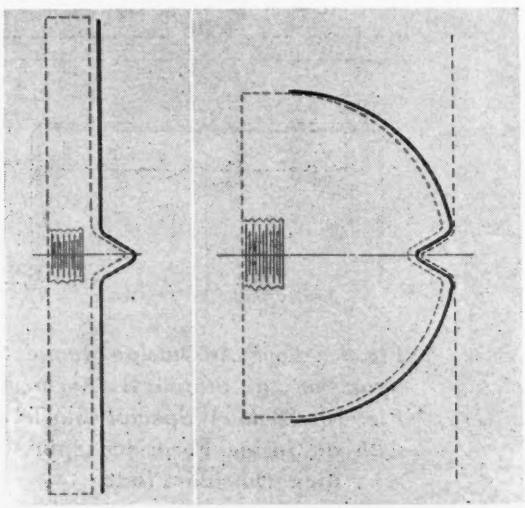
Fig. 9. (Above) An Outside Flange Spun on a Standard Form. Fig. 10. (Below) Special Block with an Inside Form for Spinning Outside Flange



Figs. 11 and 12 (Above)



Figs. 13 and 14 (Above)



angles saves spinning time, eliminates extra operations, reduces the cost, and improves the appearance of the product.

Spinning an outside bead on a product requires less time and is more economical to form than an inside bead. Fig. 6 represents a sheet of metal spun over a standard form, and Fig. 7 indicates how an outside bead can be added to this straight-sided cylindrical shape, without changing the original form, by using a beading tool. A second form, as shown in Fig. 8, is needed to make an inside bead, to prevent the sides of the cylinder from bulging while the beading is being done.

Inside and outside flange angles should have as liberal a tolerance as possible to avoid the use of another, more expensive form. In Fig. 9, a single block is used to form an outside flange, as the design tolerances permit some springback of the metal flange edge. When an absolutely flat flange and an accurate flange angle are specified, a second block and an inside form to keep the base firm are required, as shown in Fig. 10. A single extra outside form, as shown in Fig. 11, can be used to form an inside flange when liberal depth and diameter tolerances are allowed. When, however, the flange must be spun to exacting tolerances, an expensive collapsible split form is needed. This complicated form, an example of which is shown in very limited detail in Fig. 12, is necessary to permit the release of the inside form from the finished part.

Figs. 13 and 14 illustrate a typical example of the reduction in cost and improvement in appearance of a spun-metal shape obtained by redesign. Fig. 13 shows the original design of a stainless-steel cover with sharp angles. Fig. 14 shows the same cover redesigned to reduce all the angles, giving a streamline appearance and saving time and money in the spinning operation by preventing excessive strain on the metal at the corners. The avoidance of sharp angles also eliminates the need for annealing operations.

Another example of the redesign of a product to permit economical spinning is the hemispherical mixing bowl illustrated in Figs. 16 and 17. The original design, shown in Fig. 16, with the sharp

Fig. 11. (Top View) Spinning an Inside Flange with a Simple Form. Fig. 12. (Bottom View) Collapsible Split Form for Spinning an Inside Flange to Close Tolerances. Fig. 13. (Center Left) A Stainless-steel Cover with Sharp Angles. Fig. 14. (Center Right) Cover Shown in Fig. 13 Redesigned to Facilitate Spinning. Fig. 15. (Bottom Left) Extra Block Required to Spin the Sharp Indentation in the Bowl Shown in Fig. 16. Fig. 16. (Bottom Right) Hemispherical Mixing Bowl that Presented a Difficult Spinning Job

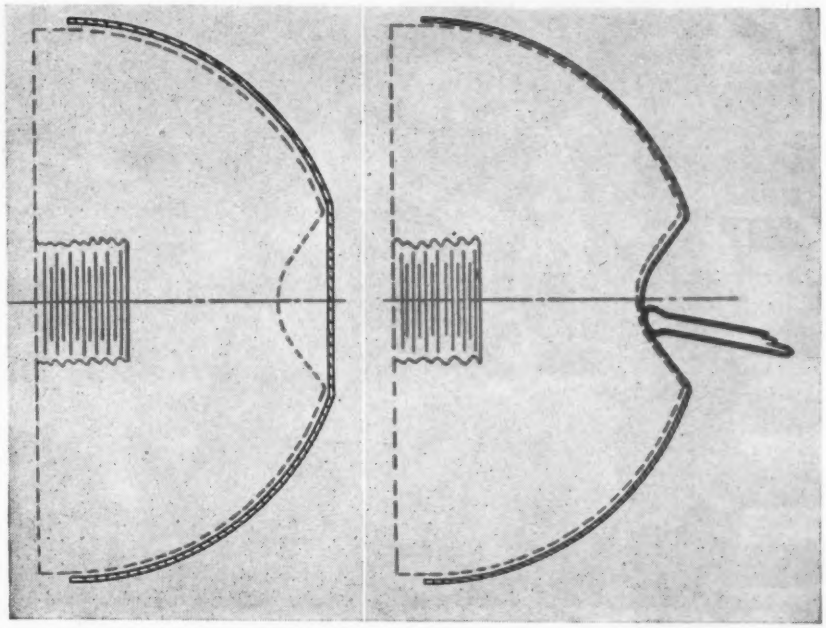
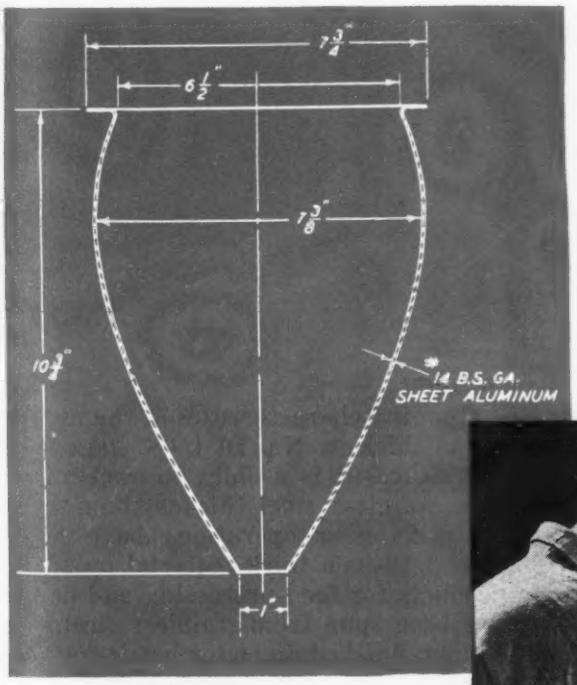


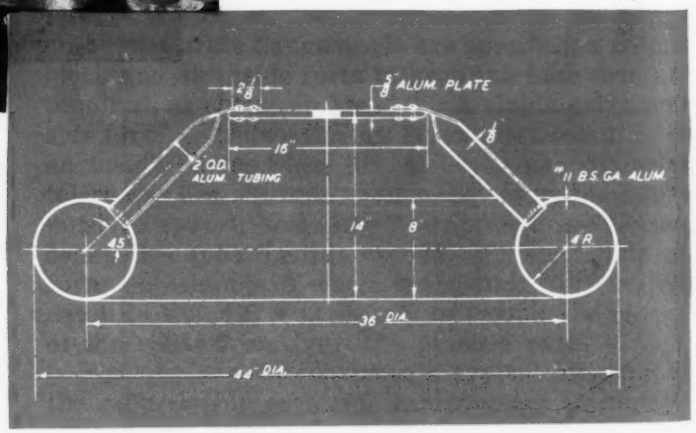
Fig. 17. (Left) Redesign of the Bowl Shown in Fig. 16 to Permit Spinning on a Single Form. Fig. 18. (Right) Push-in Operation for Forming Indentation in Bowl



indentation at the base, required an extra block for an external "spin down" operation, as seen in Fig. 15. This operation stretched the metal and thinned it out at the base where thickness was especially desired for strength. By redesigning to give a larger radius to the indentation, it was possible to use a form that had this indentation cut out in the bottom, as shown in Figs. 17 and 18. It was then possible to form the indentation by means of a push-in operation, as illustrated in Fig. 18, on the same form and set-up that was used for spinning the bowl.

Fig. 19. An Aluminum Reflector Spun to a Depth of 10 3/4 Inches. Shape and Dimensions of Spun Part are Shown in Cross-sectional View

Fig. 20. Doughnut-shaped Section of This Corona Shield Assembly is Spun in Two Halves from Flat Aluminum Blanks. Drawing Shows Dimensions of Assembly



Aluminum and its alloys are well adapted for cold spinning. Being very ductile, aluminum may be spun in all gages up to 1/2 inch thick and to greater depth than any other material. The reflector illustrated in Fig. 19 was spun to a depth of 10 3/4 inches from a sheet of No. 14 B & S gage 2S-0 aluminum. The corona shield assembly shown in Fig. 20 is used in conjunction with insulator assemblies to support the antenna and various parts of the antenna circuit in high-power, long-wave radio stations. The doughnut-shaped piece of this corona shield assembly was spun in halves, each half from a 47 17/32-inch diameter flat blank of No. 11 B & S gage aluminum. The spun halves were welded together and the welds ground smooth. 17S-0 and 24S-0 are the most difficult and costly aluminum alloys to spin, and 52S-0 and 53S-0 aluminum are not as adaptable to deep spinning as the other aluminum alloys.

Magnesium and Dowmetal are more difficult and costly to spin than aluminum. Shallow shapes of these materials can be spun cold, but most jobs are spun hot, because the heat makes the metal more workable. Limitations regarding the size and gage of these metals that may be spun depend upon whether proper heat can be maintained on the work for best spinning characteristics of the metal. Stainless steel as thick as No. 10 U. S. gage can be spun economically. It is usually impractical to attempt to spin stainless steel thicker than this; however, certain flanging operations have been accomplished on 3/16-inch thick material by spinning. Many products for food-processing and dairy equipment have been spun from stainless steel, including 90 1/2-inch finished diameter heads for the ends of the inner linings of milk storage tanks.

Copper and copper alloys up to 1/4 inch thick can be spun with deep contours. However, intermediate annealing operations are occasionally necessary to restore the metal to its original ductile condition. Steel, tin, nickel, and Monel metal are other metals commonly spun.

Equipment for Steel Wool Manufacture

In Modern Steel Wool Equipment, Several Thousand Steel Strands are Cut Simultaneously from Small Wire by Almost Six Hundred Tools. Such Machines will Convert Ten Miles of Steel Wire into Steel Wool Every Six Hours

WHILE the manufacture of steel wool has been the subject of several articles in the technical press in the past, and an idea has been given of the principles employed in different types of machines used in the steel wool industry, the methods used for producing steel wool on a high-production basis are not generally known. Equipment designed for this purpose is described in this article.

Fig. 1 shows a machine that was built by the Thompson Grinder Co., Springfield, Ohio, for steel wool manufacture. In the operation of this machine, wire is constantly drawn from a large spool *A* and carried thirty-six times around the machine by grooved drums *B* and *C*. During this period, 576 tools continuously shave the wire to produce between 2000 and 3000 strands of steel wool, each tool cutting from one to twenty-five strands. The tools are arranged on both sides of the machine in vertical rows of thirty-six each, as indicated at *D*.

Groups of the individual strands of wire are gathered together and drawn from the machine as a ribbon or rope in the manner shown at *E*, *F*, and *G*. Devices of the construction shown at *H* not only draw the ribbons from the machine, but at the same time "marcel" waves into them, producing

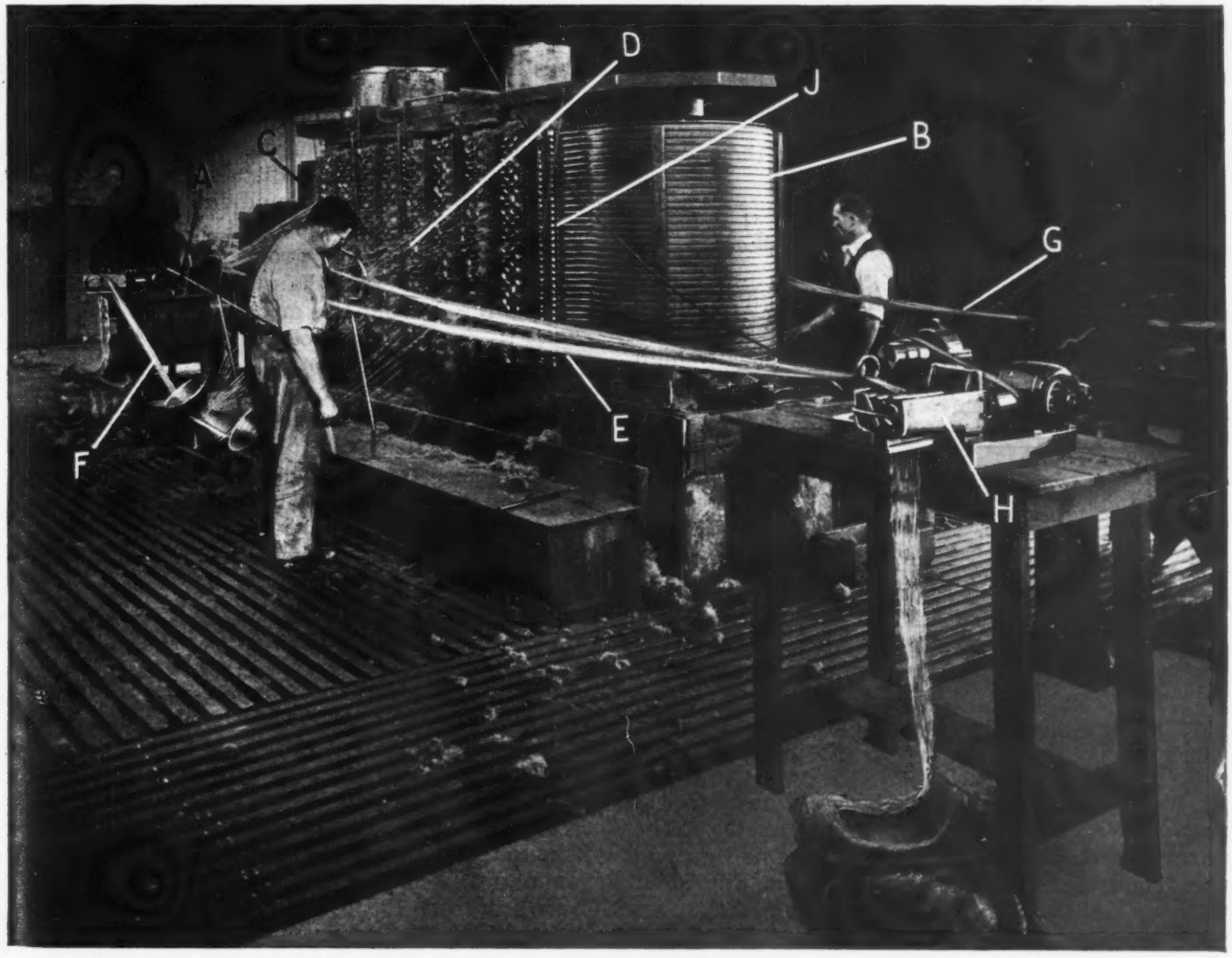


Fig. 1. Machine Designed for Producing Steel Wool on a High-production Basis. About Six Hundred Tools, Arranged on Both Sides of Machine, Shave Wire Continuously as it Rotates about Cylinders B and C

the appearance of wool. As it leaves the roller devices, the wire resembles carded sheep wool in feel, as well as in appearance, except for color. About fifteen miles of wire are run through the machine in a nine-hour day.

More than one grade of wool can be produced on a machine at the same time by providing different tools in several adjacent horizontal rows, so as to cut strands of different sizes, and then drawing all strands of the same size into one ribbon. The strands are triangular in shape, the greatest height of a triangle ranging from 0.0075 to 0.012 inch in the different grades. Human hands do not touch the wire from the time it enters the machine until the scrap leaves it.

The machine shown can produce, with two operators, some 175 pounds of steel wool per hour, as against 1 1/2 pounds by the process that was used about thirty-five years ago. Before the present continuous one-way process was developed around 1930, the reversible process was employed, in which the wire was reciprocated between the tools. The new process produces a much higher quality of wool, having about four and one-half times the strength of the earlier product. The increased strength is attributed to the fact that the wire is always shaved with the grain, instead of across it. Ribbons or ropes of wool miles long could be produced continuously if this were desirable. Most wool, however, is cut up into bunches weighing either one pound or one ounce. These bunches may be packed loosely into boxes for the market or pressed into compact pads.

Wire Used for Making Steel Wool

Wire of No. 12 steel wire gage (0.105 inch in diameter) and of a special analysis and special drawing is used. The wire has an unusually high tensile strength, which enables it to be pulled under the shaving tools until it has been cut away to less than 10 per cent of the original diameter. The wire is stretched taut under the tools and around the drums, but the load on the wire at any point is never more than 32 pounds, because of the fact that power is applied to each portion of the wire that contacts with either drum; thus power is supplied for pulling the wire beneath each horizontal row of eight tools. Adjacent to both sides of each drum is a row of thirty-six rollers, as shown at *J*, which exert pressure on the wire and keep it in the grooves of the drums.

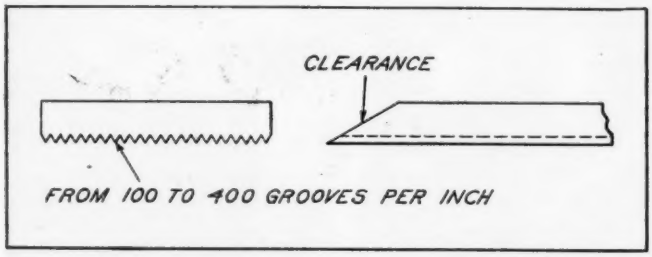


Fig. 2. Diagrammatic View Showing Construction of Cutting Edge of Wire Shaving Tools

The wire is purchased in coils weighing about 300 pounds each, and eight coils are usually wound on spools of the type shown at *A*, extra spools being on hand so that when a spool becomes empty, a loaded spool can be quickly put into its place. The ends of the wire coils are butt-welded together, so as to form a continuous wire. Also, when the wire from one spool has been fed into a machine, the end of this wire is welded to that of the new spool. This practice eliminates the necessity of "threading" each new wire through the machine and makes the process truly continuous. The wire rarely breaks while in the machine; but when it does, the broken ends are merely welded together again. Portable electric equipment is employed for the welding. When the wire leaves spool *A* and enters the machine, it passes between straightening rollers which remove all kinks.

Size of Drums and Speed of Machine

Drums *B* and *C* are 36 inches in diameter and are placed at a center-to-center distance of 9 feet, which means that there is almost 1000 feet of wire on the machine at one time. Four different drum speeds are obtainable, so that the wire may be fed at a similar number of speeds, of which the slowest and fastest are 70 and 182 feet per minute, respectively. The wire first engages the lowest groove of the drums and rises a distance of one groove spacing with each pass around the machine. The drum grooves are annular, and are 1 1/4 inches apart, the corresponding grooves of drum *C* being located 5/8 inch higher than those of drum *B*.

Power for driving the machine is derived from a 35-H.P. motor in the center of the bed, which transmits the power to a four-speed gear-box. From the gear-box, the power is delivered to each drum through worm-gearing, worm-gears being mounted on the drum-shafts. Each drum assembly runs in Timken tapered roller bearings. Devices *H* are driven by separate 1/4-H.P. motors. The scrap wire which leaves the machine is cut into 18-inch lengths by an automatic shear, and is then bundled for sale to the steel mill.

How the Tools are Designed and Arranged

Tool steel of a special analysis is generally used in making the tools, but recently high-speed steel has been substituted in many cases. The steel is obtained in bars 1 inch wide by 5/16 inch thick, and is cut up in lengths of 4 inches. Then V-grooves of 70-degree included angle are ground on one side of the tools for the entire length, as illustrated diagrammatically and greatly enlarged in Fig. 2. There are from 100 to 400 grooves per inch, depending upon the grade of steel wool which the tools are to produce. At each end, the tool is machined away to an angle of about 30 degrees to permit the steel wool to leave the tool on as straight

a line as possible. When there is insufficient clearance, the wool becomes brittle and breaks easily. After the tool has been given a special hardening and tempering treatment, the cutting edges are carefully lapped with rouge.

A recent development in the precision-truing of fine-grain grinding wheels permits the use of high-speed steels for the tools. The advantages are as great as one might expect in changing from high-carbon tool steels to 18-4-1 high-speed steel. By means of a process known as "Truforming" the Thompson Grinder Co. has been able to produce high-speed steel tools in pitches up to 400 per inch, ground from a solid hardened blank. This process eliminates the usual decarburization of the fine teeth, in addition to providing much longer life at a fraction of the former cost.

Triangular steel wool strands are cut because of the serrated cutting edges of the tools, and more than one strand is produced by most tools, due to the fact that several of the cutting vees are in contact with the wire. Each tool is so mounted in a holder that the cutting edge is held at the proper angle to the wire. Thumb-screws on the holder permit of increasing or decreasing the pressure of the tool on the wire.

All thirty-six tool-holders in every vertical row are mounted on a slide which may be adjusted vertically on ways of the machine frame. When the tools are first set up, each tool is positioned with the extreme lower portion of the cutting edge in contact with the wire. Every morning, the tool-holder slide is adjusted downward 1/8 inch, so as to bring a new portion of the cutting edge of each tool into contact with the wire. As the tools are 1 inch wide, each cutting edge lasts eight days before resharpening is necessary. The adjustment feature of the tool-holder slides also provides for readily positioning the successive vertical rows of tools at the proper heights.

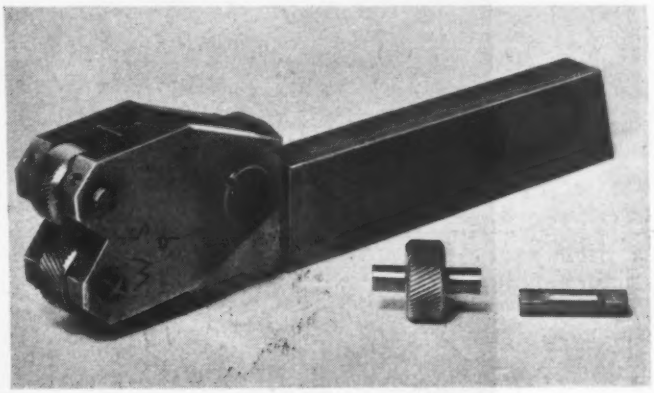
Comparatively Little Lubricant is Used

High-grade steel wool is free from oil. In this continuous process of manufacture, only 10 per cent of the oil used in the previous reversible process is required, and this oil is disposed of before the wool leaves the machine. Immediately after the wire leaves the straightening rolls when it enters the machine, it slides over a 3-inch roller which is partly submerged in a tank of heavy mineral oil, and thus a good quantity of oil is delivered to the wire. In addition, there are strips of felt between the vertical rows of tools on each side of the machine which carry oil to the wire from a reservoir on top of the machine.

To remove all oil after it has served its purpose, four pipes on each side of the machine deposit kerosene in drops on the wire in back of each two tools. Owing to the heat of the wire, the kerosene vaporizes and consumes most of the oil in the wool, so that the wool is nearly dry as it is drawn into the ribbon or rope. The machine described is completely covered by patents.

Carboloy Pins Reduce Maintenance of Knurling Tools

The use of Carboloy in place of the conventional steel pins formerly employed for mounting knurling tools in their holders has enabled Yale & Towne Mfg. Co., Stamford, Conn., to virtually eliminate knurling tool maintenance and to increase the life of knurl rolls. Although the pins that hold the knurl rolls in place in the holders were formerly made of either high-speed steel, S A E 3140, or drill rod, they would wear rapidly, usually lasting less than a day. The knurling rolls



Knurling Tool Provided with Carboloy Pins for Holding Knurl Rolls

picked up steel from the pins and tore the pins so badly that the rolls jammed, sometimes ruining both the tool and the work-piece before the machine could be stopped.

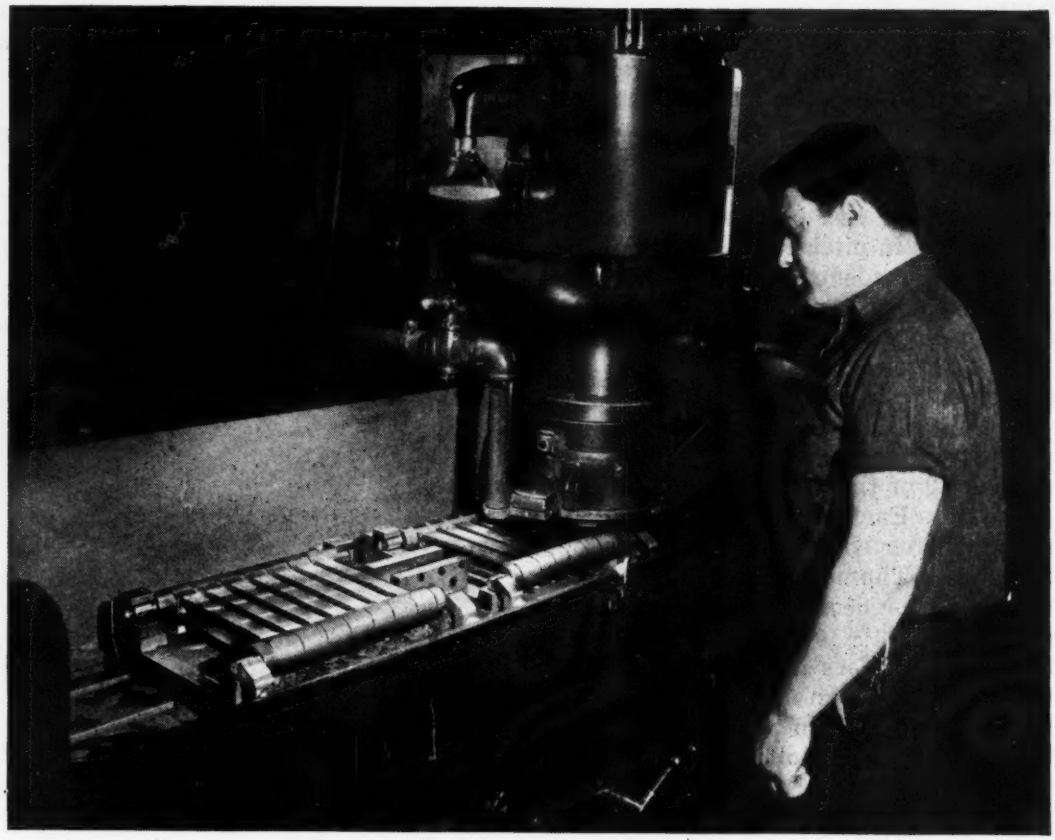
To overcome these difficulties, solid Grade 883 Carboloy standard boring bit rods, 7/8 inch long and 1/4 inch in diameter, were used for the pins. Flats were ground on both ends of each pin. The pins were pressed into place in the knurling tool, and were further held by set-screws which bottomed against the ground flats. The original Carboloy pins have already run in steady service for more than three months without replacement.

* * *

Sectionalized Assembly or Production Line

A combination conveyor and mechanized work-table for assembly, inspection, or packaging operations has been made available to industry by the Island Equipment Corporation, 101 Park Ave., New York 17, N. Y. This equipment can be assembled in as many units as may be desired. Known by the trade name "Unitable," it can be lengthened, shortened, and moved from one place to another with ease. Side leaves can be added or removed from either side of the conveyor work-table at a moment's notice. Any required combination of units involves only the removal or application of a few bolts. The conveying belt used with the work-table is actuated by a "Powerpac" unit.

Modern Flat Surface Grinding Practice



Economy, Accuracy, Increased Production, and Better Finish are Obtained by Modern Methods of Grinding Flat Surfaces. Types of Surface Grinding Machines, the Design of Parts for Surface Grinding, and Materials that can be Surface Ground are Discussed in This Article—the First of a Series on the Subject

By J. C. ARNDT and W. S. HALLOWELL
Simonds Abrasive Co., Philadelphia, Pa.

GRINDING should be considered for finishing any flat surface, especially one that requires greater accuracy or finer finish than can be obtained by a roughing cut with conventional cutting tools. It is also useful for generating certain formed surfaces. If the design of the piece is such as to permit economical grinding, and if the right type of grinding machine is selected, production is often higher and the cost less than can be achieved by other material-removing methods.

Savings Obtained with the Surface Grinding Process

Fig. 1 shows a job being ground on a Hanchett face grinder, the time required being 1 1/2 hours, compared with 7 hours needed by the method formerly used. The part is a bed casting, 30 inches high by 40 inches wide by 16 feet long, weighing about 8000 pounds. In making long beds, some of which are 40 or 50 feet in length, it is often necessary to construct them in sections which are later joined. The mating surfaces should have the accuracy and good finish easily obtained by grinding.

For facing one side of bushings, gears, collars, and similar pieces accurately parallel to the other side, surface grinding is ideal from the standpoint of accuracy and low cost. It is cheaper to grind the cut-off end of a collar or bushing than to try to hold it to close limits for size and flatness on a turret lathe or screw machine. A typical example is the manufacture of internal gears, which were formerly bored and faced on both sides in a turret lathe. With the present method, the turret lathe is used for boring and for facing one side of the gears, but the opposite side is ground on a Blanchard vertical-spindle machine. In spite of the time required to transfer the work from turret

lathe to grinding machine, the production is now 96 pieces per hour, compared with 20 by the former method.

It is not only in the machining operation itself that costs can be decreased and production increased by grinding. The greater accuracy and improved finish obtained by this process often reduce the time required for subsequent operations, or eliminate the need for them entirely. Some parts, such as those in rotary pumps, must be so accurate and of such fine finish that they will provide a liquid-tight seal when assembled without gaskets. This usually necessitates lapping after machining. Unless the finish of the unlapped pieces is excellent, considerable time may be required for the lapping operation. The lapping time on 3-inch diameter cast-iron rotary pump bodies was reduced to 15 seconds by grinding them instead of doing the preliminary rough machining by other methods. Forty-five of the bodies are ground in one set-up, removing from 0.020 to 0.025 inch of stock.

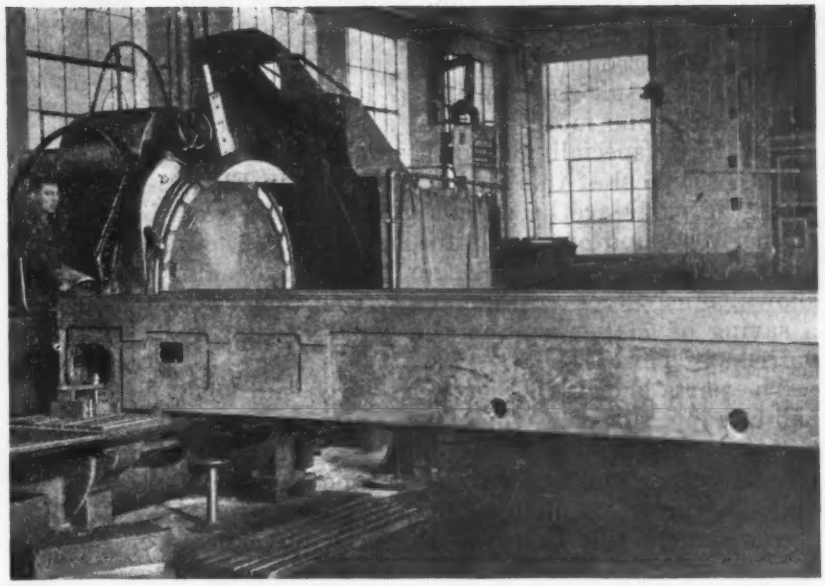


Fig. 1. Grinding the Face of a 16-foot Long Bed Casting

Hand-scraping of machine ways is a long, expensive operation which until recently was thought to be absolutely necessary for well built machine tools and other machines. Many ways are now ground instead of planed with a great saving, due to reduced machining time and elimination of scraping. The base casting of one machine tool is now finish-ground instead of scraped with a saving of 60 per cent in the time required. In that shop, the substitution of grinding for scraping made it possible to transfer 80 out of 125 workmen in the scraping department to other work on which they were badly needed. Some of the jobs were formerly thought to be impossible to grind, but special work-holding fixtures made grinding of most parts possible.

Other substantial savings result from improved accuracy, which reduces scrap, reworking, and hand-fitting during assembly. The savings often amount to half or more of the assembling cost. Considerable savings are often effected by changing from one method of grinding to another. This is sometimes accomplished by substituting a machine of a type better suited to the job. For example, to attain maximum production, a machine grinding with a cylindrical or segmental wheel requires a free sweep for the wheel, with no obstructions. Certain kinds of obstructions can be avoided by grinding with the periphery of a straight wheel, but to avoid obstructions with a cylinder wheel, while it can sometimes be done, wastes time.

The job shown in Fig. 2 represents an example of how costs were cut by changing the grinding method. The piece is a large die of very hard steel, and the surface to be ground is practically uninterrupted. For reasons that will be explained later, such jobs should practically always be done with machines using segmental wheels. Yet this job had formerly been done on a horizontal-spindle machine with the periphery of a straight wheel. Changing to the Hanchett vertical-spindle grinding machine shown and utilizing the face of a seg-

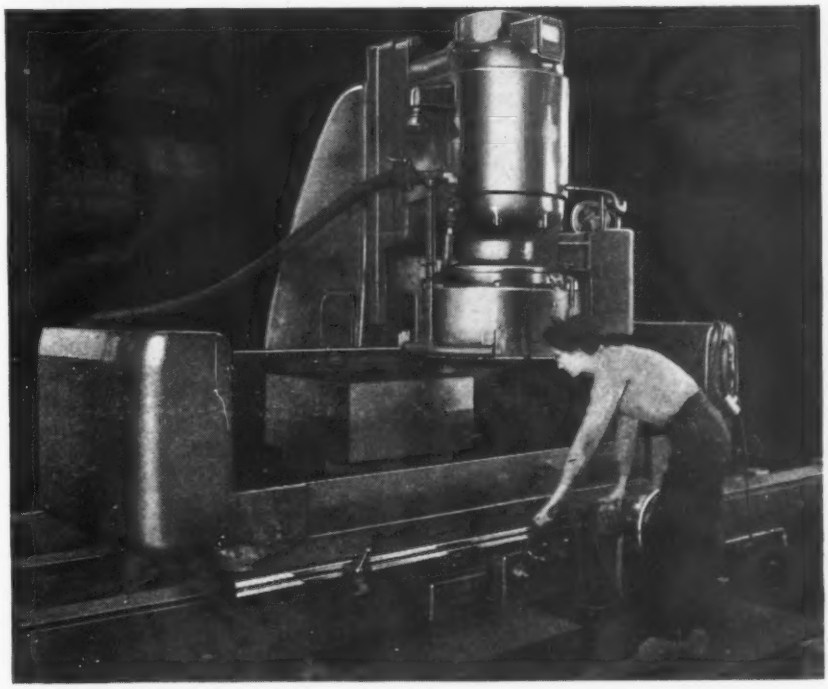


Fig. 2. Die Surface being Ground on a Vertical-spindle Machine Using a Segmental Wheel

mental wheel reduced the time required for grinding by about 83 per cent.

Decreased grinding costs and increased production often result from using a larger machine, which can grind more pieces at a set-up, or using automatic or specially designed single-purpose machines. Typical of this is the job shown in Fig. 3. Here the parts are head slide guides, which were formerly ground one at a time, requiring 36 minutes per piece. With the larger Mattison machine shown, nine pieces are handled at one time, with a saving of 77 per cent in the grinding time required per piece.

The parts shown in Fig. 4 are large and small ball-bearing spacers, which are ground in pairs with the smaller spacer inside the larger. Formerly these were ground one pair at a time on a small surface grinder, requiring 20 minutes per pair. The present method is to grind them on a vertical-spindle, rotary-table Blanchard machine using a cylinder wheel. Eighteen pairs of spacers are set up on the machine at one time. They are ground on both sides at the rate of 144 surfaces per hour, or twelve times the former rate. Parallelism is held to limits of 0.0002 inch.

A case where production was increased by the use of a special machine is shown in Fig. 5. This is a three-spindle Hanchett machine equipped to grind the parallel sides of both small and large ends of connecting-rods. These surfaces are in different planes with respect to each other. Two of the three grinding wheels are segmental and grind the surfaces of the large ends of the connecting-rods. The sides of the small end of the rod are ground with a small cylinder wheel. This special-purpose machine greatly increased production over the former grinding method, the output now being 700 rods per hour, with both sides of each end ground.

Needless to say, the fact that one machine can do a job better than another is not necessarily a reflection on the machine formerly used. Each machine is designed for certain types of work which, it is fair to assume, it will do satisfactorily. When the results obtained are not satisfactory, this may be due, not to the fact that the machine is faulty, but to the judgment of the shop man who picked the wrong machine for the job. Of course, in emergencies, it is sometimes necessary to use a poorly suited machine because it is the only one available. One of the aims of this series of articles is to help the reader decide which type of grinding machine will best do whatever job presents itself.

Fig. 4. Grinding Eighteen Pairs of Ball-bearing Spacers in One Set-up on a Vertical-spindle Grinding Machine

Surface grinding machines are commonly classified by the type of wheel used, and by the table movement. Most machines that use segmental or cylinder wheels have vertical spindles, and may have either a rotary or a reciprocating table movement. However, machines commonly known as "face grinders" use a segmental wheel on a horizontal spindle. They may be of either the traveling-table or traveling-wheel type. Machines that grind with the periphery of a straight wheel may also be of either the rotary or the reciprocating table type.

Another kind of machine used for flat surface grinding is called a "disk grinder." The wheel is similar in shape to a straight wheel, but the grinding is done on one side of the wheel. The other side of the wheel contains inserted nuts or bolts, or is attached to a plate, for mounting on the machine.

The characteristics, advantages, disadvantages, and variations of each of these methods of grinding flat surfaces will be discussed in

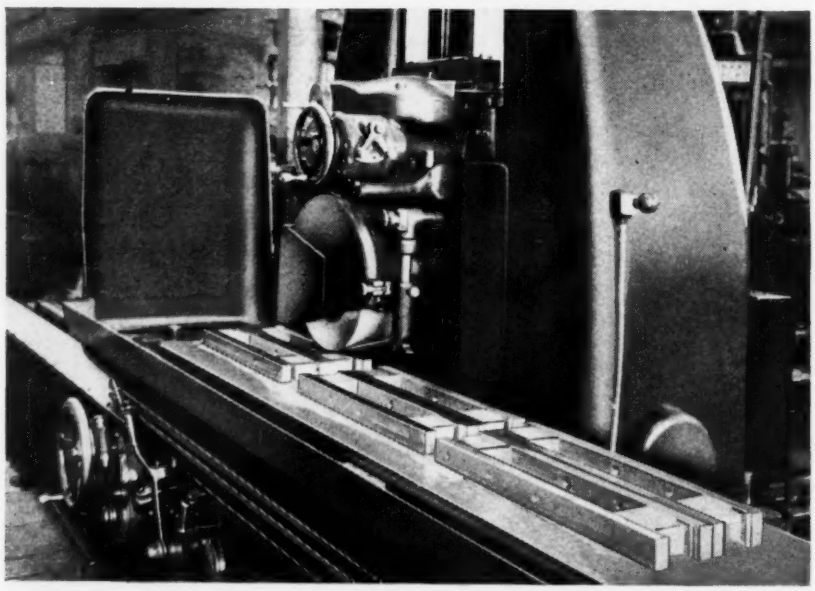


Fig. 3. Head Slide Guides are Ground Faster by Using a Multiple Set-up on a Large Machine

future articles of this series. All the basic machines, while primarily general-purpose grinders, can be altered in design to serve as single-purpose machines in cases where high production on a single kind of work is required.

Designing Parts for Surface Grinding

At first, surface grinding as a means of finishing flat surfaces was slow to be adopted because most parts were designed for machining by the older, more usual methods. As the advantages of grinding became known, and as the demand for closer accuracy and better finish became more widespread, designers gave thought to the necessary limitations of grinding and began to design their products to permit them to be ground on one or another type of machine. A natural development was the altering of designs to permit parts that were already being ground to be ground more rapidly and less expensively. Grinding-conscious as most designers now are, there is still much room for improvement in product design—especially by making parts easier to hold, load, and unload, so that simpler, less expensive fixtures can be used.

A common fault in design which prevents a part from being ground effectively is the tendency of some designers to make a casting or forging enough over size to permit planing, shaping, or milling, even though it is known that the part actually will be ground. Because scale is hard on cutting tools, it is necessary to leave enough material so that the cutter can get under the scale. That is not necessary in grinding, for wheels cut scale with no difficulty. Nor do hard spots in a casting have any effect on the cutting speed.

The grinding wheel is admittedly not an efficient means of removing material in heavy cuts. While cuts of 1/4 inch depth or more are possible in grinding, 1/16 inch or less is all that should be left on most castings for grinding, and many cuts on forgings from the rough are measured in thousandths. As a rule, when more than 1/4 inch of material must be removed, one of the other metal cutting methods is indicated, which, unless absolutely necessary, wastes both time and material.

To get the advantages in cost, production, accuracy, and finish that grinding provides, parts should be designed for grinding so that as little material as possible is left to be removed. Instances of redesign to reduce material removal and so make grinding possible are numerous. In one case where material on each side of a cover plate was reduced 9/32 inch, the annual material saving was nearly 22,000 pounds, and the saving in machining time amounted to about 1800 hours.

Avoiding Large Unbroken Surface Areas

Excessive unbroken surface areas may make it impractical to grind a part. This is especially true when using segmental or cylinder wheels, or a disk grinder, because the area of contact between wheel and work is large and the difficulty of getting adequate coolant to the point of contact will result in overheating. This often precludes the use of grinding, which might otherwise be the most economical method.

Excessively large areas are usually provided for contact between parts that are to be fastened together, such as bed-plates, cover-plates, sides of parts, and the like. Just as good a contact can usually be obtained if the bearing area is broken up with bosses, beads, and recesses. One of the easier ways to reduce the area to be finished by grinding is to recess certain areas and grind only the top surfaces of the shoulders formed by the recesses. If the part is too thin to permit weakening it by recessing it, the area to be ground can

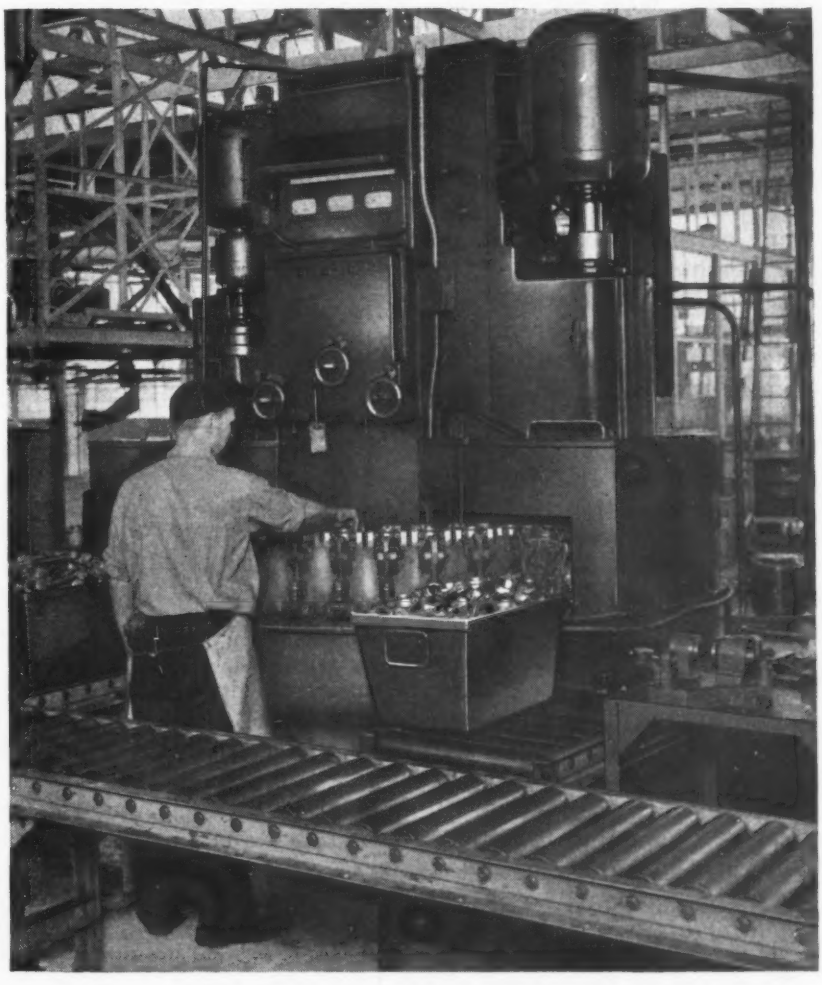


Fig. 5. Special Three-spindle Machine for Grinding the Parallel Sides of Both Ends of Connecting-rods

often be reduced through the addition of pads, bosses, and beads.

Some typical instances of redesign are given in the following: The base of a light machine had an area of 18 square inches to be finished—too much in this case to make grinding advisable—so it was milled at the rate of 4.6 hours per hundred pieces. By recessing so as to leave only a few pads and a bead around the edge, disk grinding became feasible and production was reduced to 0.8 hour per hundred pieces. Of course, there was also a great saving in material.

One shop rather ill-advisedly persisted in grinding, with a segmental wheel, a part that had an unbroken area of nearly 100 square inches at the low rate of 100 pieces in 24.7 hours. Redesign cut the area to about 8 square inches. This was accomplished by providing a rectangular hole in the center of the plate, which cut the area in half, and recessing, which left only a peripheral bead and beads around two slots and two bolt-holes.

Avoiding Projections that Interfere with Grinding

Projecting parts usually preclude surface grinding with segmental or cylinder wheels, since such wheels must be able to sweep across the surface at each pass. With some designs, it is possible to get around projections when grinding with the periphery of a straight wheel, but this usually greatly slows the operation. Typical of such parts are those that have numerous bosses, especially if their ground surfaces are in different planes. For such jobs, milling is usually preferable, or even necessary. One maker of office machines found that many of the side plates contained bosses of varying heights. They were redesigned to bring all finished boss surfaces in one plane, so that the plates can now be ground a dozen or more at a time, with no interference. Careful study of a part, coupled with an acute awareness of the economies of grinding, will usually show a way to eliminate all projections which would get in the way of a grinding wheel.

Rapid production by surface grinding is sometimes made impossible by features in the design of a part that preclude the quick and easy loading of the work on a magnetic chuck. It takes time to prop or jack up a part so that a level surface will be presented to the grinding wheel. To avoid that trouble, a printing press manufacturer redesigned may of his parts so that all bosses are in the same plane, and small bosses have been added where needed to support the piece properly for grinding. Production has been speeded up and great savings effected by simplifying the fixtures and reducing their cost.

Materials Suitable for Surface Grinding

There are no limitations to the kind of material that can be surface-ground. Any materials that can be machined by any method can be ground—and many materials can be ground that no tool can cut. The scope of grinding thus embraces all of the ferrous metals, including the very hard ones. The ability to finish-grind a piece after hardening is very important. All the non-ferrous metals, such as aluminum, magnesium, copper, brass, and bronze can be ground. Among the non-metallic materials regularly ground on a production basis are clay products, glass, carbon, plastics, quartz, agate, and sapphire.

In the early days of surface grinding, even the greatly increased production was not always enough to give a lower cost per piece, as compared with other machining methods. When costs could be determined accurately, the decisive factor was often the grinding wheel costs, which were apt to be high due to the low machine table speeds which were the rule. Low table speeds necessitated the use of very soft wheels, which wore rapidly. Today the table speeds of most machines are much higher —as high as 150 feet per minute. Much harder wheels can be used without glazing or loading. They wear less rapidly, and the abrasive cost per piece is so low that total grinding cost is often lower than the tool cost for other methods. At the same time, grinding wheel manufacturers have developed wheels better suited to surface grinding. They are at once free-cutting and long-lived, even under heavy cuts on a production basis.

Most surface grinding machines are very versatile. One machine may be taking roughing cuts on a casting just as it came from the foundry, while an identical machine may be finishing a surface to a few ten-thousandths inch for dimension, flatness, and parallelism, and to a few micro-inches for surface quality.

* * *

Multi-Flex Ducts for Air, Gases, and Powdered Material

As a result of wartime research by Watson G. Harding, development engineer of the United States Rubber Co., a new type of flexible corrugated duct made of fabric, rubber, and plastics has been evolved which has many possibilities for conveying air, dust, fumes, and abrasive substances in machine-building and industrial plants. Perfected early in the war in response to the Army's request for a light highly flexible tube for carrying oxygen through the nostrils of horses which might be caught in enemy gas attacks, the manufacturing process was later adapted to the manufacture of ducts for heating, ventilating, and defrosting American war planes. These ducts can also be used on automobiles, railway cars, and other vehicles.

The Multi-Flex ducts are light in weight, durable, and easy to install. They can be twisted and turned around obstructions, thus saving installation time. They are easily repaired, and if crushed, will resume their normal shape as soon as the pressure is released. They withstand temperatures from 350 degrees F. to minus 70 degrees.

Broaching Blind Holes with Multiple Short Broaches

AN ingenious application of broaching on a job for which, at first glance, this process seemed impractical was recently made by the Colonial Broach Co., Detroit, Mich. The job involved the production of short helical splines in the blind hole of an automotive transmission part so designed that tools cannot be passed through the work.

Broaching was made possible by simply under-cutting a recess beyond the section of the part to be splined, so as to provide broach clearance at the end of the cut. This recess can be seen in the unmachined part illustrated at the right in Fig. 1. Ten short broaches, each provided with five sets of broaching teeth, as seen in Fig. 2, are employed for this job in place of a conventional long broach. Instead of the broaches being actuated as in customary broaching practice, the work-piece is held in the moving ram head of the broaching machine. The machine is equipped with a master lead-screw which is operated by the ram movement to provide the swiveling action of the work necessary for cutting the helical splines. The broaches are mounted on a hydraulically actuated indexing table.

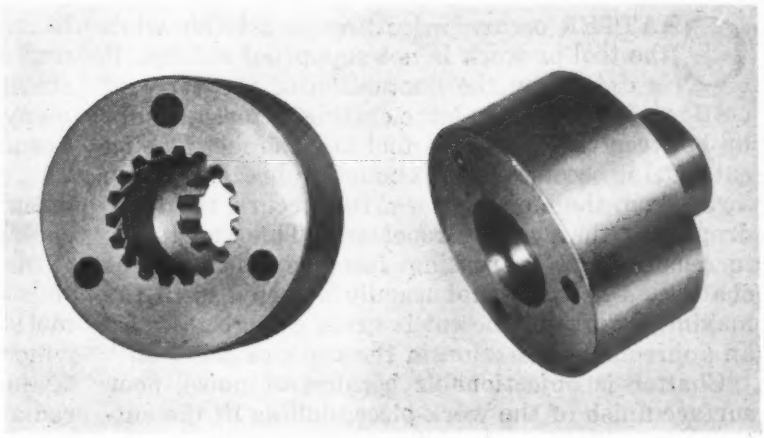


Fig. 1. Transmission Part having a Blind Hole in which Short Helical Splines are Cut by Progressively Employing Ten Short Broaches

The machine cycle is completely automatic. After the operator loads a part and pushes a button, the ram moves downward and pushes the part over the first broach. The ram then returns with the work-piece to the upper position and stops, after which the table indexes automatically to the next station. This cycle is repeated until the part has been pushed down over all ten broaches, at which time the machine stops for reloading.

The broaches must be spaced exactly, and so located that the teeth of the different broaches will "track" each other as they progressively cut the spline to the finished size and shape. With this arrangement, the cutting effect of the ten short broaches is the same as if a single long broach were used.

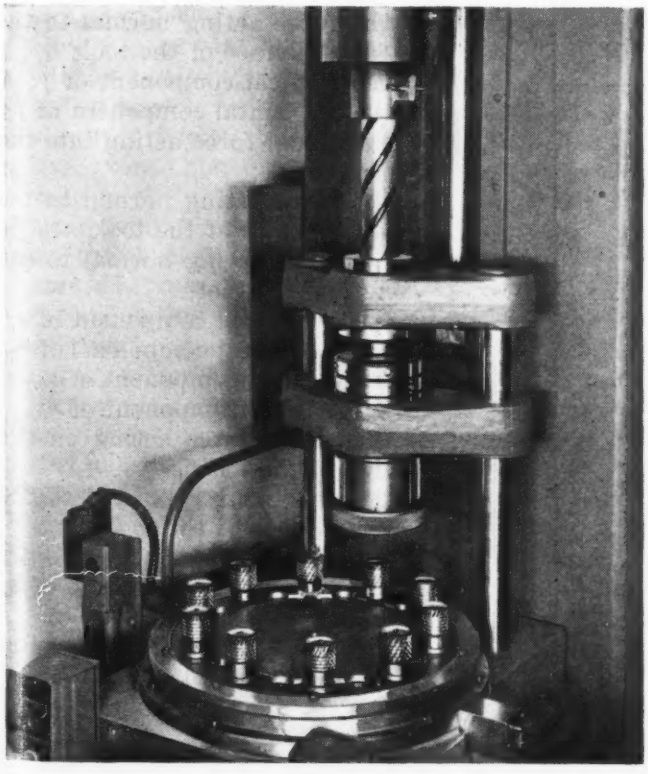


Fig. 2. View of Tooling Provided on Broaching Machine for Cutting Helical Splines in the Blind Hole of Automotive Transmission Parts

* * *

Motion Picture on New Aluminum Alloy

A 16-millimeter sound motion picture which shows the foundry technique and procedures in casting a new aluminum alloy, the laboratory methods by which the alloy is tested and checked, and a great variety of applications has been brought out by the Frontier Bronze Corporation, Niagara Falls, N. Y. One scene, taken with an ultra high-speed camera to demonstrate the shock resistance inherent in Frontier 40-E—the new alloy—as compared with other alloys, shows a 95-pound iron ball being dropped on identical castings of several alloys. The action is slowed down about two hundred times to permit a close observation of the comparative resistance factors. The film, which was produced by McLarty Films of Buffalo, N. Y., runs for one-half hour.

Grinding Lathe Tools to

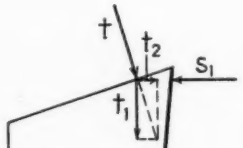
CHATTER occurs, in cutting on a lathe, when the tool or work is not supported rigidly. It is caused by the fluctuation of the force of cutting on the tool. In lathe cutting, a force is built up between the top of the tool and the metal being cut until it becomes great enough to break the chip away from the metal. When this occurs, the force drops and the cycle is repeated. This constantly increasing and decreasing force is what causes chatter. Chatter is not usually detected until the maximum force of the cut is great enough to cause an appreciable deflection in the work or the tool.

Chatter is objectionable because of noise, poor surface finish of the work-piece, dulling of the cutting edge of the tool, and possible damage to the machine. It can usually be eliminated by making the work and tools more rigid; changing the speed, feed, depth of cut, or shape of the tool; and periodically adjusting the working parts of the machine to eliminate unnecessary play or lost motion. The first consideration in eliminating chatter should be stabilization of the work and tool. However, in many instances, the rigidity of the work or tool cannot be increased. This article will be confined to a discussion of change in tool shape, which can often reduce and in a great many cases eliminates chatter.

In turning on a lathe, there are usually three cutting forces acting normal to the surfaces of the tool: The top force t (or the tangential force), which is caused by the metal being cut pressing against the top of the tool; the front force f (or radial force) caused by the front of the tool rubbing on the work due to the depth of cut; and the side force s (or longitudinal force) caused by the tool being forced into the work by the feed of the lathe.

In practice, the measurable force acting on the work or the tool is usually a combination of two of these three forces. These measurable forces will be designated by capital letters, as follows T is the actual force acting down on the top of the tool; F the actual force acting back into the tool shank; and S the actual force acting on the side of the tool. These and the following symbols for components of the forces will be used in the illustrations and discussion:

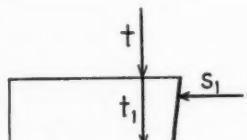
f = the force acting normal to the front surface of the tool;
f_1 = the vertical component of f;
f_2 = the horizontal component of f;
F = the actual force acting into the tool shank;
s = the force acting normal to the side surface of the tool;
s_0 = the force acting normal to the nose of the tool;
s_1 = the horizontal component of s;
s_{10} = the horizontal component of s_0;
s_2 = the vertical component of s;
s_{20} = the vertical component of s_0;
S = the actual force acting on the side of the tool;
t = the force acting normal to the top surface of the tool;
t_1 = the vertical component of t;
t_2 = the horizontal component of t; and
T = the actual force acting down on the top of the tool.



As the side-rake angle is increased, t_2 increases, and

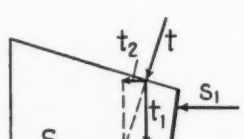
$$S = s_1 - t_2$$

Therefore, as t_2 increases, S decreases, or *as the side-rake angle increases, S decreases and T decreases.*



When the tool has no side-rake angle,

$$t = t_1$$
$$t_2 = 0$$
$$S = s_1$$



As the negative side-rake angle is increased, t_2 increases. However, t_2 is in the opposite direction to the side thrust caused by a positive side-rake angle, and

$$S = s_1 + t_2$$

Therefore, as t_2 increases, S increases, or *as the side-rake angle increases negatively, S increases and T decreases.*

Fig. 1. Three Front Views of a Tool Showing Positive, Zero, and Negative Side-rake Angles, and Their Effect on the Force Acting on the Side of the Tool

Eliminate Chatter

By C. W. CHRISTIANSEN

Practically all tools used for cutting steel and cast iron have rake. This rake or slope of the tool face forces the chip to slide off the tool in the direction desired, reduces the cutting force required by increasing the keenness of the cutting edge, and up to a certain point, increases the life of the tool. However, the keener the cutting edge, the sooner the sharp edge will fail. The amount of rake a tool should have depends upon the work for which it is intended. It can usually be varied somewhat without seriously influencing the tool performance. Figs. 1 and 2 illustrate how a change in side-rake and back-rake angles affects the forces acting on the side and into the shank of the tool.

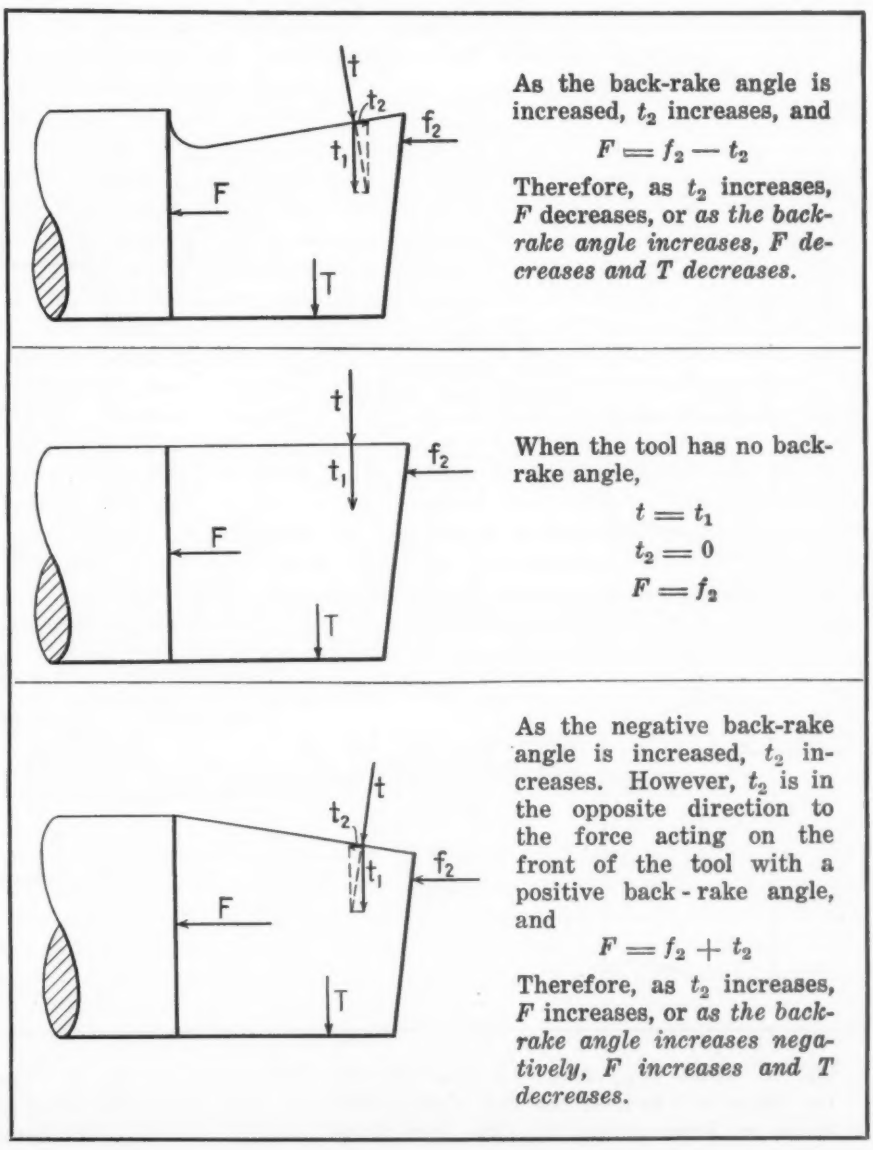
The upper, center, and lower views of Fig. 1 illustrate positive, zero, and negative side-rake angles, respectively. It can be seen from these diagrams that as the side-rake angle is increased from zero, the actual force acting on the side of the tool S decreases, and as the negative angle is increased from zero S increases. The actual force T acting down on the top of the tool will decrease as the positive or negative side-rake angle is increased. Similarly, it could be demonstrated that if the side relief angle were increased, s_1 would decrease (decreasing S) and s_2 would increase (decreasing T). However, the side relief angle cannot usually be increased without weakening the tool.

The upper, center, and lower views of Fig. 2 illustrate positive, zero, and negative back-rake angles, respectively. It is clear from these examples that as the back-rake angle is increased from zero, the actual force F acting into the tool shank decreases, and as the negative angle is increased from zero, F increases. The actual force T acting down on the top of the tool will decrease as the positive or negative back-rake angle is increased. In the same manner, it can be shown that if the end relief angle were increased, f_2 would decrease (decreasing F) and f_1 would increase (decreasing T). However, the end relief angle cannot usually be increased without weakening the tool.

The effect of changing the side cutting-edge angle on the force F acting into the tool shank is illustrated by the three views in Fig. 3. As the side cutting-edge angle increases from zero, F increases. Similarly, it will be evident that as the end cutting-edge angle is increased, f_1 will decrease (decreasing F) and f_2 will increase (decreasing S).

From Fig. 4 it can be seen that as the nose radius is increased, F increases. However, if the nose radius is increased beyond the point at which it will be entirely engaged in the cut, there will be no effect on s_{20}.

These principles can be applied to all types of work done in the lathe. The conditions in facing and boring are the same as in turning. With grooving, cutting off, or threading operations, there is no side force to cause chatter. In conclusion, it can



As the back-rake angle is increased, t_2 increases, and

$$F = f_2 - t_2$$

Therefore, as t_2 increases, F decreases, or *as the back-rake angle increases, F decreases and T decreases.*

When the tool has no back-rake angle,

$$t = t_1$$
$$t_2 = 0$$
$$F = f_2$$

As the negative back-rake angle is increased, t_2 increases. However, t_2 is in the opposite direction to the force acting on the front of the tool with a positive back-rake angle, and

$$F = f_2 + t_2$$

Therefore, as t_2 increases, F increases, or *as the back-rake angle increases negatively, F increases and T decreases.*

Fig. 2. Three Side Views of a Tool Showing Positive, Zero, and Negative Back-rake Angles, and Their Effect on the Force Acting into the Tool Shank

be said that to reduce or eliminate persistent chatter, the side cutting-edge angle or the nose radius should be decreased, or the rake angles should be changed. In changing the rake, the most commonly encountered type of chatter may be reduced by increasing the positive back-rake angle.

* * *

In giving orders, don't be stingy with explanations. Clear explanations of the reasons for doing a thing in a certain way may prevent many a mistake. A little note in the corner of a drawing will often save dollars in the shop.

Three Weeks' Management Course Offered by University of Iowa

A three weeks' management course starting June 10 and ending June 28 is announced by the University of Iowa, College of Engineering, Iowa City, Iowa. The course is designed primarily for plant managers, foremen, industrial engineers, and others who wish to obtain comprehensive training in production planning, plant lay-out, motion and time study, wage incentives, and related subjects. It combines fundamental training with practical applications. Further information can be obtained directly from the university.

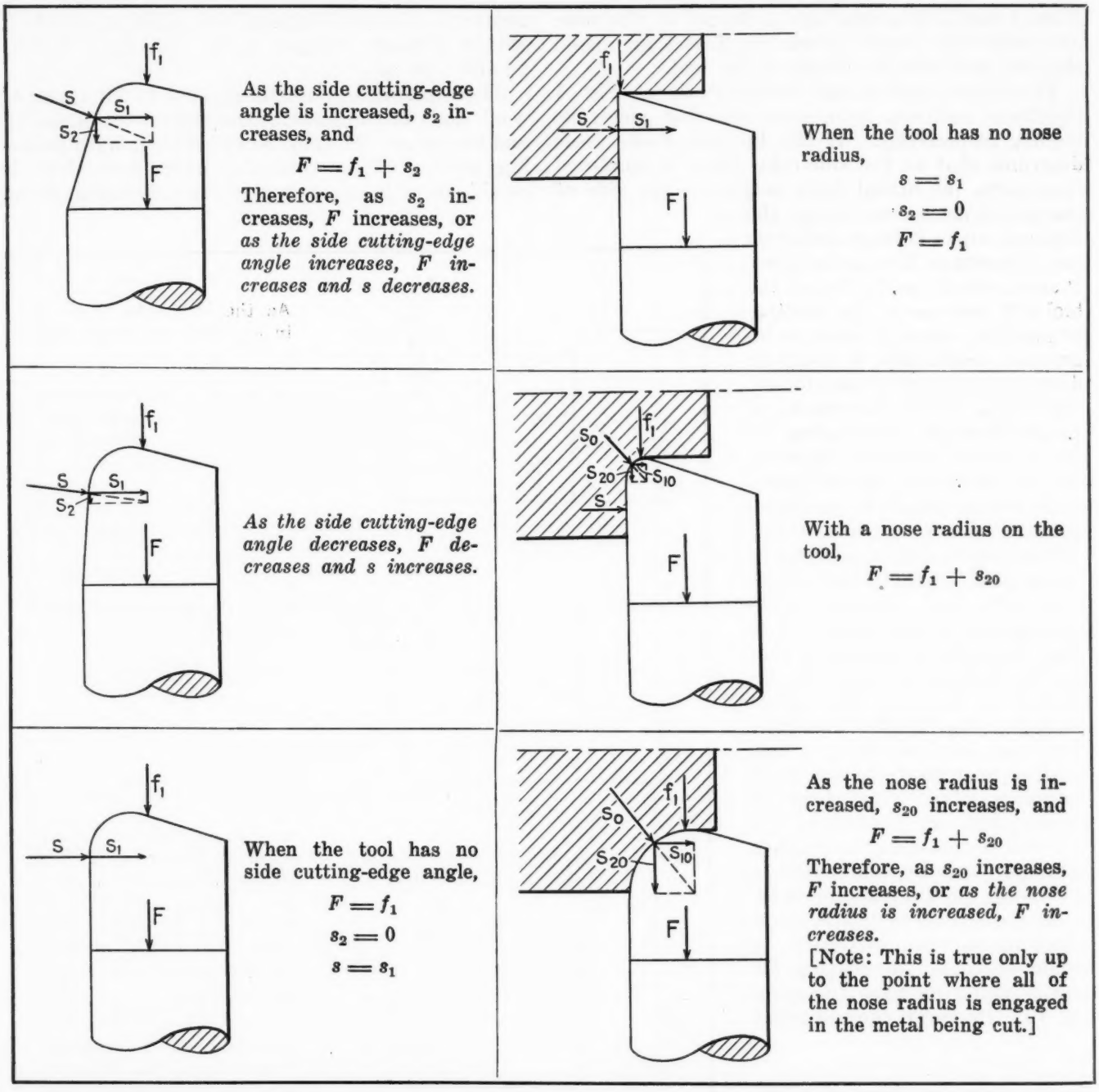


Fig. 3. Three Top Views of a Tool Showing the Effect of Changing the Side Cutting-edge Angle on Force Acting into the Tool Shank

Fig. 4. Three Top Views of a Tool Showing the Effect of Changing the Nose Radius on the Force Acting into the Tool Shank

American Society of Tool Engineers Elects New Officers

A. M. Sargent, Newly Elected President of the American Society of Tool Engineers

W. B. Peirce, First Vice-president of the American Society of Tool Engineers

Thomas P. Orchard, Second Vice-president of the Tool Engineering Society

AT the annual meeting of the board of directors of the American Society of Tool Engineers, held in Cleveland in April, the following officers were elected for the ensuing year: President, A. M. Sargent, of the Pioneer Engineering Co., Detroit, Mich., succeeding C. V. Briner, of the Pipe Machinery Co., Cleveland, Ohio; first vice-president, W. B. Peirce, vice-president of the Flannery Nut & Bolt Co., St. Louis, Mo.; second vice-president, Thomas P. Orchard, general manager of the American Tool Engineering Co., New York City; third vice-president, Irwin F. Holland, general superintendent of the small tool and gage department, Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn.; national secretary, R. B. Douglas, works manager of the Propeller Division Canadian Car & Foundry Co., Ltd., Montreal, Quebec; and treasurer, V. H. Ericson, vice-president of Johnson de Vou, Inc., Boston, Mass. W. Dawson, of the F. F. Barber Machinery Co., Ltd., was re-elected assistant secretary-treasurer, and Harry E. Conrad was re-elected executive secretary.

The directors elected by the House of Delegates, at its first meeting under the Society's new constitution, were: A. J. Denis, president, Murphy-Denis Corporation, Los Angeles, Calif.; R. B. Douglas; Irwin F. Holland; Thomas P. Orchard; W. B. Peirce; A. M. Sargent; A. M. Schmit, general manager, A. M. Schmit Co., Toledo, Ohio; Grant S. Wilcox, Jr., assistant master mechanic, Plymouth Division Chrysler Corporation, Detroit, Mich.; C. B. Cole, owner, Tool Equipment Sales Co., Chicago, Ill.; and A. G. Collins, chief industrial engineer, Hughes Tool Co., Houston, Tex.

Government Policy Discourages New Enterprises

JOB-CREATING enterprises depend upon savings which the savers are willing and able to invest and risk. We have heard it said frequently by the New Dealers and by labor leaders that "capital is on strike" and refuses to venture its savings as it formerly did, and that because of this condition the Government must make up the deficiency of private investment.

A knowledge of what the present income and inheritance taxes are doing to the income group from which nearly all risk capital formerly came supplies the most important reason for the fact that less private risk capital is now available. People with large incomes can keep very little of their incomes for their own use or for investment. Another reason why private investment of risk capital has declined so much during the past decade is that the Government has made such investment less attractive.—*Stevenson, Jordan & Harrison, Inc., Management Engineers*

Engineering News

Experimental Gas Turbine in Successful Operation

An Allis-Chalmers experimental gas turbine has been in successful operation at a gas temperature of 1350 degrees F. at the Naval Engineering Experimental Station at Annapolis. Designed and built by the Allis-Chalmers Mfg. Co., Milwaukee, Wis., for eventual operation with hot gas at a temperature of 1500 degrees F., this 3500-H.P. unit is said to be the first large multi-stage gas turbine for continuous power generation at high efficiency ever operated at such a high temperature.

Although this gas turbine has been developed for the Navy, its basic elements make it suitable for both land and marine practice. The gas-turbine plant is arranged with two turbines operating in parallel, one supplying the power required to drive the compressor, and the other furnishing the power for the driven equipment.

Torpedo-Shaped Jet Engine Developed to Drive Planes on Long Flights

A new axial-flow turbo jet engine shaped like a streamline torpedo, has been developed by the General Electric Co. to drive military and civilian planes at great speeds on long flights. Sustained high speed is possible for planes driven by the new jet engine, since these engines function most economically when running at nearly full throttle. This means that the cruising speed of an axial-flow jet engine is practically top speed. When functioning at that rate, it will drive a plane farther on a given amount of fuel than at a lower speed.

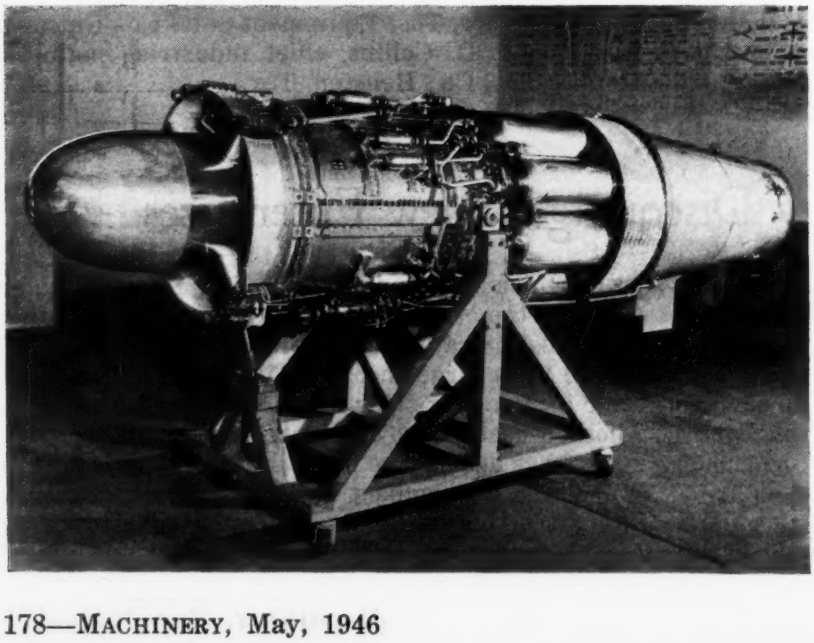
The new engine is expected to be suitable for operating planes at speeds in excess of 500 miles an hour. At about this speed, the efficiency of the propelling equipment begins to decline sharply. The new engine is light in comparison with reciprocating engines, and will fit more snugly into the wings of a big civilian plane than equally powerful reciprocating engines.

Honeycomb Sheets Provide Strong, Light Construction Material

A "honeycomb" of cotton cloth, paper, Fiberglas, or linen sandwiched between and bonded to thin sheets of aluminum, stainless steel, wood veneer, or plastic provides a strong, light-weight, waterproof construction material. This material was developed jointly by the Glenn L. Martin Co., Baltimore, Md., and the United States Plywood Corporation of New York.

The material from which the honeycomb core is formed is impregnated with a phenolic resin. The type and thickness of facing will vary with the load requirements. Sheets as large as 7 by 30 feet have been made by the United States Plywood Corporation, and the thickness may be as low as 1/8 inch. The weight of the core can be made as little as 4 pounds per cubic foot.

The Martin Co. is using this material for cabin floors in the fuselages of Model 202 transports. Walls, ceilings, doors and partitions in railroad cars, automobiles, and buildings are possible uses for this material. While the material has as yet only been produced in flat sheet form, experiments are being made with fabricating curved surfaces.



New Turbo Jet Engine Developed by the General Electric Co. for Driving Military and Civilian Planes at Great Speeds on Long Flights

Westinghouse Stages Its Tenth Annual Machine Tool Electrification Forum

THE tenth annual Machine Tool Electrification Forum of the Westinghouse Electric Corporation was held at the William Penn Hotel, Pittsburgh, Pa., April 9 and 10. A varied program had been prepared, consisting of papers dealing with recent electrical developments pertaining to the machine tool industry, as well as addresses of general interest in this field. One of the papers covered case histories and practical applications of adjustable-speed drives, in the presentation of which participated W. B. Wigton, electrical engineer, Cincinnati Planer Co.; B. T. Anderson, electrical engineer, Sundstrand Machine Tool Co.; and R. W. Moore, motor engineering department, Westinghouse Electric Corporation. The subject "Tailored Motors for Reversing Service" was dealt with by R. H. Clark, Warner & Swasey Co.; E. Y. Seborg, Barnes Drill Co.; and L. W. Herchenroeder, Westinghouse Electric Corporation.

Standardization of electrical equipment was given a prominent place on the program. Industry reports on standardization were presented by A. P. O'Neill, assistant plant engineer, Pontiac Division of General Motors; E. J. Rivoira, electrical engineer, Cincinnati Milling Machine Co.; and G. A. Caldwell, manager, Control Engineering, Westinghouse Electric Corporation. A standardized control transformer for built-in application was discussed by E. E. Opel, electrical engineer, National Automatic Tool Co., and C. E. Herr, transformer engineering department, Westinghouse Electric Corporation.

Among other addresses on electrical subjects should be mentioned "Disconnect Circuit Breakers for Machine Tool Control," by H. D. Dorfman, of the AB Breaker Engineering Department of the Westinghouse Electric Corporation; and "One Company's Trends in Machine Tool Wiring Methods," by A. L. Krause, electrical engineer, Brown & Sharpe Mfg. Co.

There was also much of interest to the machine tool manufacturers and designers present in the addresses on more general topics that were a feature of the Machine Tool Electrification Forum. After a showing of the motion picture "Dawn of Better Living," Burnham Finney, editor of the *American Machinist*, spoke on "What is Ahead for the Machine Tool Industry?" outlining in considerable detail the present conditions and trends. "The Outlook for Foreign Business" was the subject of a talk by W. E. Knox, vice-president, Westinghouse Electric International Co.

"Engineering—Today's Subject" was the title of a highly informative address by M. W. Smith, vice-president in charge of engineering of the Westinghouse Electric Corporation. "Engineering for the Future" was most interestingly discussed by C. A. Scarlott, manager, engineering publications of the corporation. J. R. Weaver, manager of the East Springfield (Conn.) Works of the corporation, spoke on "A User's Future Requirements for Machine Tools." In his address Mr. Weaver outlined the needs of industry, especially in mass production, for further machine tool developments and refinements. An abstract of this paper will be published in a coming number of MACHINERY. The subject "Elimination of Vibration in Machine Tools" was ably dealt with by R. Griffith, research department, Heald Machine Co.; this paper evoked prolonged discussion.

Finally, Tell Berna, general manager, National Machine Tool Builders' Association, gave an address entitled "Report on the Machine Tool Industry," which ended the scheduled sessions of the meeting. At the dinner following the forum, a stirring address on the present conditions in industry and the effects of Government policies was given by R. M. Gaylord, president, Ingersoll Milling Machine Co., and also former president of the National Manufacturers Association and the National Machine Tool Builders' Association. At a luncheon given during the meeting, the facts pertaining to the demands of the striking Westinghouse employes were given by G. A. Price, president of the corporation. At this occasion addresses were also presented by W. P. Kirk, president, National Machine Tool Builders' Association, and vice-president of Pratt & Whitney Division Niles-Bement-Pond Co., and by A. H. Phelps, vice-president in charge of purchasing of the Westinghouse Electric Corporation.

The meeting was attended by close to three hundred engineers and executives of the machine tool industry, in addition to a large number of Westinghouse engineers.

* * *

Determining the Base Prices of Used Machinery

Resellers of used machinery are now required to apply a new method of determining base prices in computing their selling prices, according to the Office of Price Administration. Under the provisions of the new ruling which became effective on April 13, resellers are no longer permitted to use the current list prices of manufacturers. They are required to use the list prices that were in effect on the base date in computing their selling prices.

Editorial Comment

Exceptionally large wage increases in the basic industrial fields are now an accepted fact. As a result, industrial management is faced with the job of devising ways and means for reducing the cost of production by improved methods and machinery, because if this is not done, the workers will obtain no benefit from their increased wages. Obviously nothing is gained if the increased wages are simply reflected in higher prices of all the things that the worker buys; and these higher prices are a certainty unless the cost of production of manufactured goods can be so reduced, by improved methods, that this reduction will outweigh the wage increases.

Labor leaders and the men who hold the highest offices in our Government have started the nation on a vicious spiral of inflation. There is a wise saying in the Good Book about what happens when "the blind lead the blind." If we are to be saved from the dire consequences of this type of leadership—consequences that many other nations have suffered under similar circumstances—it will be only because our industrial leaders and engineers will find ways and means to reduce costs in spite of advancing wages and prices of materials.

Do "the Blind Lead the Blind" into the Ditch of Inflation?

The cooperation of labor is also needed to the extent that time-wasting union rules be abolished, and the efficiency of labor in the manufacturing industries be raised. Unfortunately, in many fields during the war, labor efficiency was not maintained at a reasonable standard. While as a nation we accomplished wonders in the manufacture of war materials, much more could have been accomplished, in less time and at less cost, if there had been less interference by Government and more cooperation between workers and management.

▼ ▼

Many of the difficulties that have to be overcome in a manufacturing organization are due to personal preferences and pet ideas. During the war, much unnecessary delay was caused by the difficulty of manufacturing unduly complicated and time-consuming designs of war equipment. The designing engineer is inclined to overlook the question of ease and rapidity of production—in other words, cost of manufacture. It is frequently the experienced tool or production engineer who has to suggest modifications in the design to permit the application of the best and fastest production methods. Sometimes the designer objects to such suggestions because he has in mind some idea of engineering perfection. Sometimes he objects to the appearance of a changed design, suggested because the part can be more conveniently and efficiently manufactured. Then, again, he may be one of those men who believe their own ideas are always best.

The Designer Must Consider Cost of Manufacture

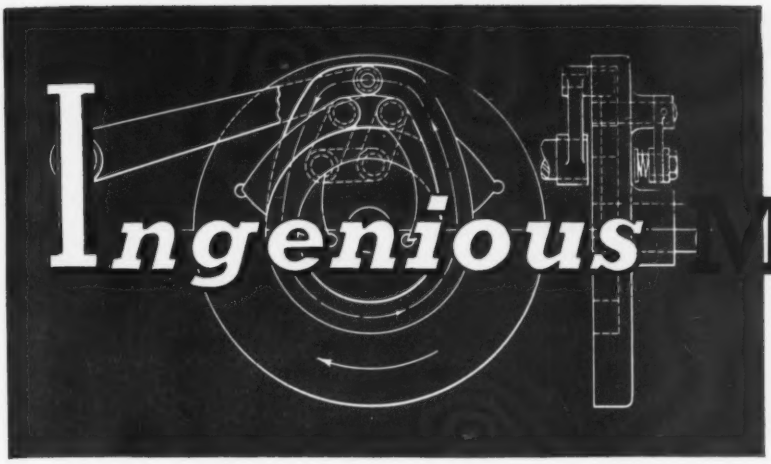
At this time, when industry is busy trying to get back into gear as quickly as possible, there is no place for mere personal preferences and pet ideas in matters of this kind. Three fundamental requirements must be met: (1) The product must be properly adapted for its purpose; it must be capable of doing what it is expected to do. (2) It must be possible to manufacture the product efficiently and without undue cost. (3) Its appearance must be satisfactory to the buyer.

▼ ▼

The tool engineer played an extremely important part in the rapid conversion of the industries of the United States from peace to war work. His services have been hardly less important in the reconversion of industry to peacetime products, because the tool engineer is the man who devises the means by which the product can be made economically. It is hardly necessary to emphasize to MACHINERY'S readers that the capable tool engineer is able not only to speed up production greatly, but also to reduce costs.

Tool Engineers Have Greatly Speeded Up Reconversion

The tool engineer, therefore, holds a key position in the reconversion program and in the efficient production of peacetime products. That he is doing his work well is evidenced by the rapidity with which war industries have been converted to peacetime work, except in instances where strikes and labor difficulties have prevented the reconversion program from being carried out on schedule. Successful results are obtained in manufacturing through the cooperation of many links in the production and distribution chain. Each link must carry its load, but among these links, tool engineering is one of the most important.



Ingenious Mechanisms

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

Irregular Intermittent Motion

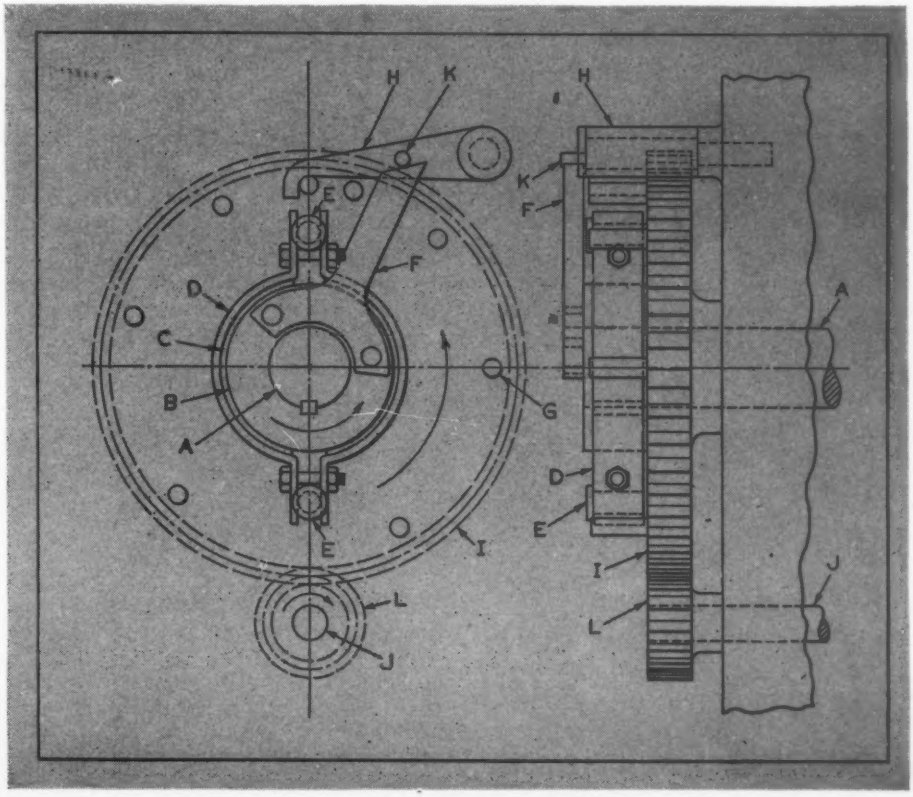
By L. KASPER

The mechanism here illustrated is designed to transmit an irregular intermittent rotating motion to shaft *J* from the driving shaft *A*, which rotates continuously at a constant speed. It is used on a machine that fabricates a wire screening material having a mesh of alternately increasing and decreasing size. The variations in the size of the mesh are controlled by the mechanism that varies the number of revolutions or fraction of a revolution made by the driven shaft *J* between the dwell periods.

Referring to the illustration, the driving shaft *A* carries the disk *B*, which is keyed to it, and rotates at a uniform speed in the direction indicated by the arrow. Gear *I* is supported freely on shaft *A*, and carries a series of pins *G* which control the various steps in the operating cycle. Gear *I* also carries two studs *E*, which serve to connect it to the two-piece band *D* which encircles the disk *B*. Band *D* is provided with a lining of friction-resistant material *C*, and is held in place by two clamping bolts which can be adjusted to regulate the frictional driving force transmitted by disk *B*.

Gear *L* meshes with gear *I* and serves to rotate the shaft *J* which operates the feed mechanism of the machine. The latch *H*, which is supported freely on a stationary part of the machine, successively makes contact with the pins *G* on gear *I* as they arrive at the top position. Disk *B* carries the arm *F*, which actuates latch *H* through contact with pin *K*.

In operation, shaft *A*, disk *B*, and arm *F* rotate



Mechanism Designed to Transmit Intermittent Rotary Motion to Shaft J from Shaft A with Varying Length of Rotating Periods between Eight Successive Dwell Periods

uniformly in the direction indicated by the arrow. The frictional driving force exerted on band *D* by disk *B* tends to rotate gear *I* through the connecting studs *E*. When the various members of the mechanism are in the position shown in the illustration, with the hook end of latch *H* in contact with one of the pins *G*, the gear *I* is restrained from rotating, and therefore no rotating motion is transmitted to shaft *J*, the disk *B* rotating against the frictional resistance of the band *D*.

Referring to the illustration, which shows arm *F* in contact with pin *K* on latch *H*, it will be evident that continued rotation of arm *F* will cause latch *H* to be lifted out of contact with pin *G*, permitting the friction drive from disk *B* to band *D* to transmit motion to gear *I* and shaft *J* through the medium of gear *L*.

When arm *F* has passed under pin *K*, latch *H* drops ahead of the next pin *G*, again stopping the rotation of gear *I*. Gear *I* remains stationary until arm *F* has completed a revolution when it again lifts latch *H* through pin *K*. As the pins *G* are unequally spaced, shaft *J* will be rotated through a varying number of revolutions or through different fractions of a complete revolution between each of the dwell periods, as determined by the location of these pins.

Intermittent Motion for Changing Timing Interval for Air-Valve Functioning

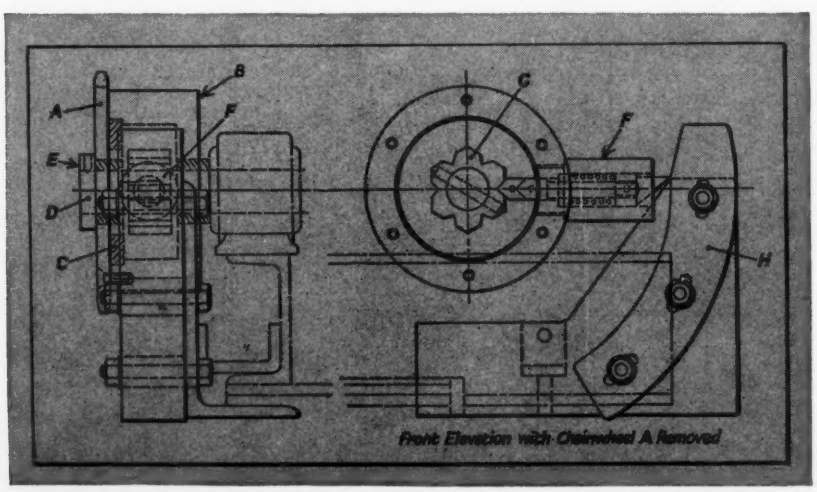
The accompanying illustration shows how a shaft *D*, which originally served to actuate an air valve once for each revolution of the chain-driven sprocket *A*, was equipped with an intermittent indexing mechanism designed to actuate the valve once every sixth revolution of the driven sprocket. Since the slow constant speed at which sprocket *A* rotated could not be changed, it was necessary to provide some means of driving shaft *D* from sprocket *A* at a reduced speed in the ratio of 6 to 1 to accomplish this change in the valve operating cycle.

Fortunately, the complete operation of opening and closing the air valve (not shown) could be accomplished in one-eighth of a revolution of shaft *D*. This made it possible to employ the cam-actuated intermittent mechanism shown, which indexes shaft *D* one-sixth of a revolution at each revolution of sprocket *A*. With this mechanism, every sixth indexing movement of shaft *D* through one-sixth of a revolution served to open and close the air valve as required.

The necessary modifications in the drive included the securing of sprocket *A* to the idling drum *B*, which is a free running fit on shaft *D*, and the provision of a collar *E* for retaining the drum and sprocket assembly on shaft *D*. The sprocket wheel is located on drum *B* by the machined ring *C*, and is held in place by countersunk-head screws. A steel housing *F*, attached to drum *B*, contains a spring-loaded pawl-ended follower. The follower, as shown by dotted lines in the view to the right, is made in two pieces, the pawl end being a square section bar with a V-shaped end. The rear end of this pawl is turned down to form a shank which is a sliding clearance fit inside the loading spring. The end of this shank is threaded to fit the threaded hole in the follower shown in contact with the cam-plate *H*.

Secured to shaft *D* is a hardened tool-steel hexagonal member *G*, which has a V-slot centrally located in each of its six flat faces. Normally, the loading spring holds the pawl out of contact with member *G*, but when the follower end comes in contact with cam *H*, the pawl end is forced into one of the slots in member *G*, causing shaft *D* to be indexed through an angle of 60 degrees, or one-sixth of a revolution. The length of the indexing movement is determined by cam *H*, which keeps the pawl in engagement with member *G* through one-sixth of a revolution and then withdraws, so that member *G* remains idle for the remaining five-sixths of a revolution.

Operation of the air valve is, of course, accomplished during one of the six indexing movements of member *G*, the other five indexing movements performing no valve-operating function. Cam *H* is provided with radial slots for the clamping screws to permit adjustment of the cam so as to insure correct timing of the engagement of the pawl and member *G*.



Intermittent Indexing Mechanism Designed to Actuate a Valve Once Every Sixth Revolution of the Driven Sprocket

Tool Engineering IDEAS

Combination Die for Blanking and Drawing a Beaded Cup

By E. BARRON

The designing of a combination die for blanking and drawing the metal cup shown in Fig. 1 from material 0.015 inch thick was somewhat difficult because of the beaded portion. The bead could, of course, be produced by a second operation on a rotary beading machine, but this method was rejected in favor of the combination die shown in Figs. 2 and 3, which was considered to be more economical from the production standpoint.

The blank size was first calculated by the equalization of area process; and, once this trial figure had been obtained, the exact dimensions were arrived at by a try-out. Referring to Fig. 2, the material is fed across the face of die *A*, using a trigger stop. The descending blanking punch *B* blanks and draws the material over the forming punch, as shown at *C*. The drawn shell conforms to the 1.625-inch diameter and is about 5/16 inch deeper than the finished product.

Three light springs *D*, which support the forming pad, are now in the fully collapsed position. The heavy springs *F* and the pressure pad must be capable of sustaining the load produced by form-

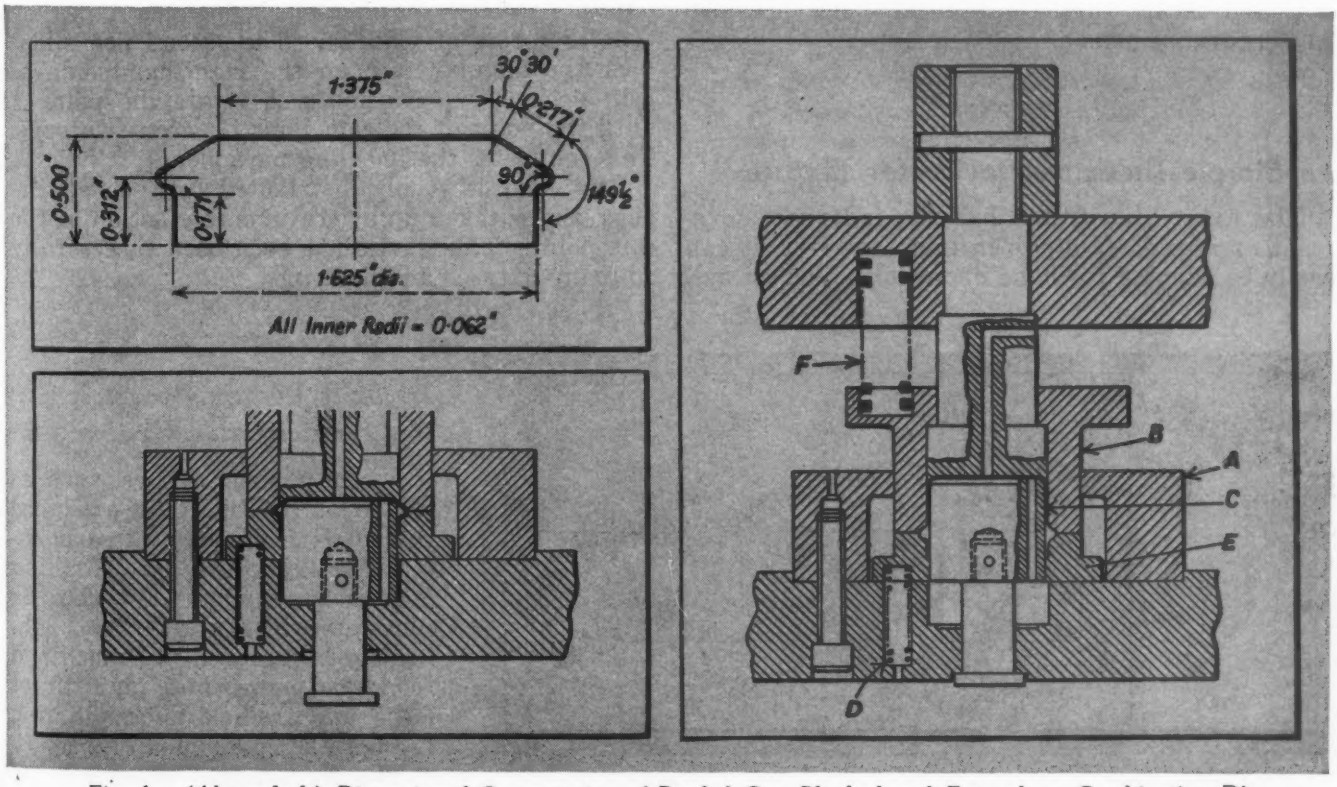


Fig. 1. (Above Left) Dimensioned Cross-section of Beaded Cup Blanked and Formed on Combination Die Shown in Figs. 2 and 3. Fig. 2. (Right) Combination Die with Blanked and Formed Cylindrical Cup Shown at C. Fig. 3. (Below Left) Die Shown in Fig. 2 at End of Down Stroke which Produces Completely Formed Beaded Cup

ing without any possibility of collapse. Hence, by finding the load required for forming and working to a suitable factor of safety, the sizes of springs *F* and the pressure-pad springs can be determined.

It may be noted that there is no downward pressure between the forming punch and blank while the latter is being drawn. This is hardly necessary, however, owing to the comparative thinness of the metal and the fact that planishing finally takes place.

When the forming pad *E* comes to rest on the bolster face, as shown in Fig. 2, further downward movement of the press ram results in the collapse of springs *F;* consequently, the forming punch travels downward against the pressure pad. The drawn metal, covering the forming punch, must, of course, travel downward also until its movement is arrested by the lower internal shoulder in the forming pad, as shown in Fig. 3. The forming punch continues downward until it reaches the bottom of the recessed hole that is provided in the bolster.

During the latter portion of the operation the metal shell, being of greater depth than is required for the finished part, is forced to conform to the desired beaded shape, which is provided by the groove formed between the blanking punch and the forming pad.

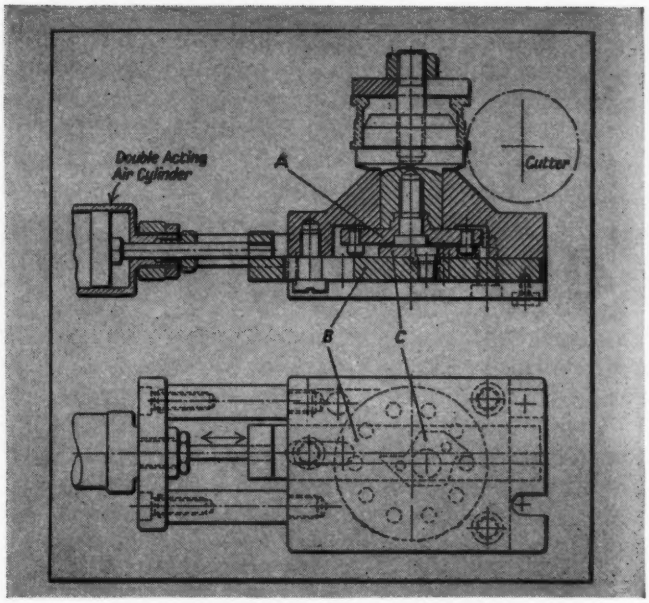
Ejection of the part is effected by compressed air, which is admitted beneath the work at intervals corresponding with the cycle of operations and controlled by the stroke of the press. For this purpose, a suitable mechanism is used. A threaded pipe carries the air to the lower recess of the bolster and thence through three air-holes provided in the forming punch.

Simple Indexing Device for Fixtures

The fixture illustrated has the indexing movement arranged for air operation; however, it can easily be adapted for hand operation. The air cylinder or hand-lever reciprocates the sliding member *B* to which the cam-block *C* is doweled. When slide *B* is moved to the left, the angular face of the cam nearest to the piston engages one of the pegs in the plate *A*, which is keyed to the vertical arbor. The peg slides over the angular face of the cam and rotates the plate through the first half of the indexing movement.

On the return stroke, the angular face on the opposite side of the cam-block engages a peg on the other side of plate *A*. The second peg slides over the angular face on the right-hand side of cam-block *C* and continues to rotate the plate *A* until the point of the cam jams between two pegs. This completes the indexing movement.

Any wear is evenly distributed between all the pegs, and is taken up by the jamming action of the cam point. This device has been used successfully on many fixtures and drill jigs.



Air-operated Indexing Device Applied to Fixture for Slotting Work

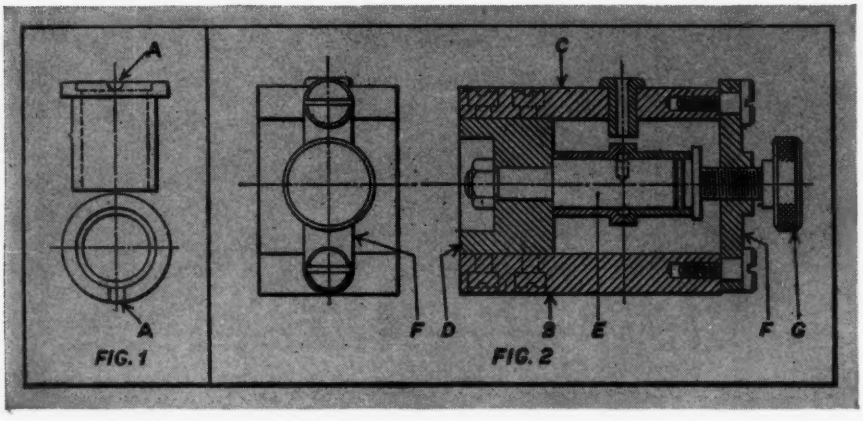


Fig. 1. Bushing with Semicircular Groove Machined in Flange at A.
Fig. 2. Jig Used on Drilling Machine to Produce Grooves Like One Shown at A, Fig. 1, in Flanges of Two Bushings Simultaneously

Drill Jig for Producing Semicircular Groove

A semicircular groove, such as shown at *A*, Fig. 1, is produced in the flange faces of two bushings simultaneously by a drilling operation performed in the jig illustrated in Fig. 2. The bushings to be grooved are machined from phosphor-bronze on a turret lathe, and are held to close limits, the bore being reamed to size.

The jig consists essentially of a base *B;* a bushing plate *C*, spaced by a parallel-faced block *D;* and a bushing for locating and

guiding the drill. The mandrel *E*, on which the phosphor-bronze bushings are held while they are being drilled, is secured to block *D* by a hexagonal nut.

The latch *F* can be swung out of the way to permit loading the jig and removing the bushings after the clamping screw *G* and its swiveling head have been backed away far enough to clear the first bushing. It will be noted that the drill bushing projects well below plate *C*, and thus supports the drill close to the work, and that ample clearance is provided for chips beneath the work.

Redesign of Blanked Part Simplifies Production

A saving in material and increased production were effected by redesigning the blanked part shown in Fig. 2 to conform with the shape illustrated in Fig. 1. With this change, it was possible to shear the part from standard material instead of blanking it from strip stock, as was required by the original design. A comparison of strip lay-outs for shearing and blanking, as shown in Figs. 3 and 4, respectively, show how the new method made possible a saving in material of approximately 40 per cent.

The simple, low-cost shearing tool (Fig. 5) used in producing the redesigned part consists of a mild-steel shank *A* with a hardened tool-steel punch *B* welded to it. The die is provided with a hardened cutting edge in the form of a tool-steel button *F*, driven into the mild-steel bolster *H* and secured by peening over its lower end. The material is fed through a slot machined in the under side of the stripper plate *C* which, together with the supporting block *E*, is screwed and doweled to the bolster *H*. The hardened peg *D* serves as a stop when feeding the material. The bolster is machined to facilitate ejection of the sheared part from the side.

D. D. M.

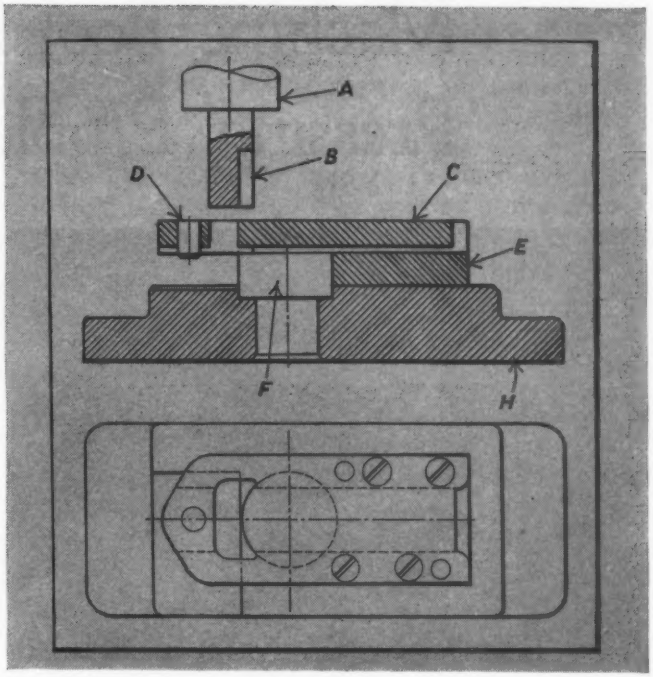


Fig. 5. Shearing Tool for Producing the Redesigned Part

New Film on Hand Miller Tooling

A 16-millimeter color sound movie entitled "The Miller that Uses Its Head" has been prepared by the Nichols-Morris Corporation, 50 Church St., New York City. Unlike many technical films, this is not a "how-to-operate" film, but is an analysis of the Nichols hand miller from the tool engineer's and tool designer's point of view.

The film takes twenty-three minutes to show. It covers many different kinds of tool and fixture design—all the way from ordinary simple fixtures to completely automatic ones, such as one for producing a double-start helix on a fuel injector plunger. This is one of the first films to deal directly with tool and fixture design. Inquiries relating to this film should be addressed to the Nichols-Morris Corpn.

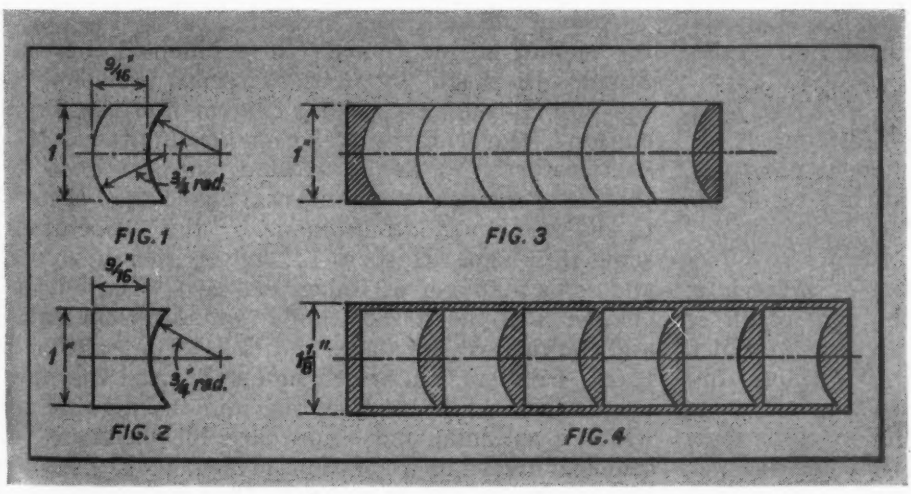


Fig. 1. Part Shown in Fig. 2 as Redesigned to Permit Shearing. Fig. 2. Original Design of Blanked Part. Fig. 3. Material Strip after Shearing the Redesigned Part Shown in Fig. 1. Fig. 4. Material Strip after Blanking the Original Part

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Frank B. Gilbreth's Films

March MACHINERY announced that a film made from the original films produced by Frank B. Gilbreth—the father of motion study—had been made available by the Chicago Chapter of the Society for the Advancement of Management. In the announcement it was stated that a charge of $75 is made for the use of the film. This was erroneous; the purchase price of the film is $75, and the rental charge $4.

Machine Tool Builders Discuss Pressing Problems of Industry

Some of the Men at the Head Table at the NMTBA Dinner. (Left to Right) James Y. Scott, President, Van Norman Co.; Herbert H. Pease, President, New Britain Machine Co.; Senator Saltonstall of Massachusetts; William P. Kirk, Vice-president, Pratt & Whitney Division Niles-Bement-Pond Co.; and A. G. Bryant, Vice-president, Cleereman Machine Tool Co. Mr. Kirk is President of the Association; Mr. Pease and Mr. Bryant are Vice-presidents

THE forty-fourth spring meeting of the National Machine Tool Builders' Association, held April 16 and 17 at the Ambassador Hotel, Atlantic City, was attended by a larger number of machine tool executives than any previous meeting of the Association. The large attendance is an evidence of the urgency of the problems now facing the industry.

In his opening address, William P. Kirk, president of the Association and vice-president of the Pratt & Whitney Division Niles-Bement-Pond Co., outlined the many problems requiring attention. He particularly emphasized the fact that industry must reduce costs of production in order to offset increased wages and higher prices of materials; otherwise, higher prices will be the only result of the present wage increases. The only way in which manufacturers can reduce costs is through improved machines that will increase the output of the individual worker. The value of machine tools must be measured in terms of output per day per man. The machine tool builder's sole aim, as far as the product he manufactures is concerned, must be increased productivity of the equipment being built. This will permit machine tool users to reach greater markets through lower prices, enable them to increase their volume of business, and necessitate the employment of more people. Tell Berna, general manager of the Association, in his report also dealt with problems of the industry.

Among the addresses presented before the meeting should be mentioned "Government Policy on Surplus Disposal," by James Y. Scott, president of the Van Norman Co., who is chairman of the Association's Government Relations Committee. Mr. Scott referred especially to what had been done by the Government surplus disposal agencies in regard to the recommendations made by the Association some time ago. Herbert L. Tigges, vice-president and sales manager of Baker Brothers, Inc., who is chairman of the Association's Committee on Sales and Service, read a paper entitled, "The Salesman Has a Problem," in which he emphasized the new trends in machine tool selling, and the manner in which a salesman must approach his problems in order to arrive at a solution advantageous both to his customers and to the firm that he represents.

Louis Polk, president of the Sheffield Corporation, in his address, urged that industry explain its policies and its problems in word and print to its

employes, to the community in which it is located, and to the public in general. Both the workers themselves and the people in the communities in which they live misinterpret industrial policies simply because industry has not taken the trouble to explain these policies and the need for them.

An address entitled "Impact of Depreciation Policies on New Equipment Purchases" was presented by Frederick S. Blackall, Jr., president of the Taft-Peirce Mfg. Co. Mr. Blackall is chairman of the Association's Committee on Fiscal Problems. His address covered a thoroughgoing investigation of the depreciation policies of member companies and their methods in regard to new equipment purchases. It advocated definite action on the part of the Association with regard to Government policies on depreciation allowances. He also suggested the formulation of policies on the part of industry in general that would tie in their depreciation allowance with their new equipment purchases.

At the Association's dinner Tuesday evening, April 16, the principal speaker was Senator Saltonstall of Massachusetts, who briefly reviewed the achievements of the machine tool industry during the war and suggested Government policies that would give industry an opportunity to use its initiative and production capacity as effectively in peace time as it did during the war.

Government and Labor Leaders Prevent Full Employment by Present Policies

IN an address before the recent meeting of the American Machine Tool Distributors' Association, William P. Kirk, president of the National Machine Tool Builders' Association, and vice-president of the Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn., emphasized the generally recognized fact that the failure of the country to achieve the post-war objectives of high-level employment, full production, and fair prices to the consumer, was due to the combined policies of Government and labor leaders, by which industrial activity has been frustrated and production in several industries brought to a standstill.

"It is time," Mr. Kirk said, "that the people of this country realized that our present difficulties are due largely to an effort upon the part of certain leaders of organized labor to force an unsound economic philosophy upon the American public—plus a labor appeasement policy on the part of our Government, under which Government has dodged the real issue under the camouflage of price control.

"One of the most amazing paradoxes in the history of our country is the current spectacle of leaders of organized labor clamoring for certain objectives, on the one hand, while on the other hand, the same leaders of organized labor pursue the very courses of action best calculated to defeat the objectives which they pretend to seek. Apparently labor leaders propose to assure fair wages by making sure that everybody turns out less work than he used to turn out. As to prices, the idea of labor leaders seems to be that labor should do so little work that there is a scarcity, resulting in high prices; and then Government should correct this situation by maintaining price controls."

As to the objective of high-level employment so frequently put forward by leaders of organized labor and certain Government officials, Mr. Kirk said: "Their approach to this subject appears to be that, since there is only so much work to be done, the work must be shared by the largest possible number of people, with each one doing less work. That may sound plausible on the surface, but it is completely contrary to the industrial history of the United States.

"There is no limit to human desires. The more things that can be produced to add to the comfort and convenience of mankind, the greater are the possibilities of industrial employment—provided the cost can be brought down so that they will be within the limits of the average pocketbook.

"Costs are brought down by the use of improved productive equipment, such as machine tools, which enable the worker to multiply his own output. When costs go down, volume of sales goes up—and when volume of sales goes up, employment goes up, and job security becomes attainable."

Mr. Kirk recommended a program of Government encouragement of full-scale production, utilization of productive equipment to its fullest extent, and discouragement of strikes and slowdowns. Contrasting this recommendation to past performance, Mr. Kirk said: "If the brainiest economists in our country stayed up all night for weeks trying to devise a program that would most surely prevent our country from getting back on its feet again quickly after the end of the war, they could not have done as good a job as has been done by some of our labor leaders and our Government representatives."

Mr. Kirk, one of the senior executives in the nation's machine tool industry, who early in the war served as a production consultant to the War Production Board and is now a member of the Metal-Working Industries Advisory Committee of the War Assets Corporation, forecasts an excellent future, provided industry can convince the American public that increased productivity is the only sure road toward fair wages, fair prices, employment stability, and a higher standard of living.

Tools for Use in B

Forms, Clamping Dies, Stationary Pressure Dies, and Shoes Used in Connection with Bending Machines for Pipe, Tubes, and Other Metal Shapes

IN an article published in April MACHINERY, page 141, the principles involved in the bending of pipe, tubes, and other metal shapes were outlined. Types of bending machines were described, and the application of ram and rotary automatic and manually operated machines was dealt with in some detail. The present article will describe the tools used in connection with bending machines.

It is an old saying that a machine is no better than the tools used in connection with it. The best bending machine will do an unsatisfactory job if the tools are not correctly designed and made. In the case of bending tools, it is especially important that they be properly designed from the beginning. Since their weight may run into tons, a correction in their design is both difficult and expensive.

The Basic Bending Tool—the Form

The form is the basic bending tool. It must be made to satisfy two general requirements: Provision must be made for attaching the form to the machine on which it is to be used, and its design must be such that it will guide the material properly as it is being bent. The first of these conditions is easily met, but the second is one that requires careful study and years of experience.

That part of the form which comes in contact with the bent material should fit the shape of the material as closely as possible. Fig. 1 shows the ways in which forms may be made to do this for various sections to be bent. The purpose of this close fit is to prevent, as far as possible, distortion in the shape of the material being bent.

While the gripping edge of the form is thus shaped like the material being bent, the over-all shape of the form is determined by the shape of the finished bend itself. That is, if the bend is to be part of a circle, the form will be circular in shape; or if the bend is to be elliptical, the form will take the shape of an ellipse, provided the form is to be used on a rotary machine.

Suppose a form is to be designed for making a circular bend. The first thing to be noted is that the radius of the form should not be quite the same as the radius of the final bend. This is because all metals are elastic to some degree. Any piece of metal being bent will spring back to some extent after being released. Hence, a bend released from a machine will no longer exactly fit the form on which it was bent. This may be noted in Fig. 9, page 147, April MACHINERY, where a gap can be seen between the bent portion of the tube and the far corner of the form.

To produce a bend of a certain radius, therefore, the form must be made with a radius which is somewhat smaller than that required in the bend. How much smaller? That depends on a number of things—the kind of material being bent, its hardness, the thickness of the material, and the length of the radius itself. For example, a 16-inch radius bend may be required on a certain tube of a given hardness. A form having a radius of 14 1/4 inches proved to be correct for making this bend. Had the hardness of the tube or its wall thickness been different, a radius of 14 1/4 inches might not have been satisfactory. Only experience, and sometimes experimentation, can be used as a guide for the exact radii of forms.

The clamping die operates in such close conjunction with the form that it may be considered part of the same tool. The clamping die should have the same contour as the material, as nearly as possible, so that it will grip the greatest possible area with the least chance of slipping. The clamping die is usually a separate tool, as may be seen in Fig. 5, page 145, April MACHINERY, but in certain cases it becomes a part of the structure of the form itself. In these cases, the form is made in two parts, split along its center line in the plane of the bend, and the clamping action on the material is caused by the two parts being squeezed against each other. For single bends, the clamping die is made to hold a straight portion of the material to be bent, so that the completed bend will lie immediately behind this clamped part. For complex or compound bends, where two bends are next to each other, a special clamping die must be made for the second bend, which will hold the curved end of the first bend. Provision must then be made in the form for a similarly shaped section into which the clamping die can push the material.

The Stationary Pressure Die

The stationary pressure die must be made to withstand the wear caused by the bent material sliding over it. Frequently this die is made exactly the same shape as the clamping die, but of a hard material which is able to resist abrasion and wear. The pressure die shown in Fig. 9, page 147, April MACHINERY, is of this type. In another common design, the pressure die is a roller which may be grooved to fit the material being bent, but which rotates on the shaft on which it is mounted, so that

Bending Machines

By E. J. DeWITT, Vice-President, and
HARRY S. NACHMAN, Engineer
Wallace Supplies Mfg. Co., Chicago, Ill.

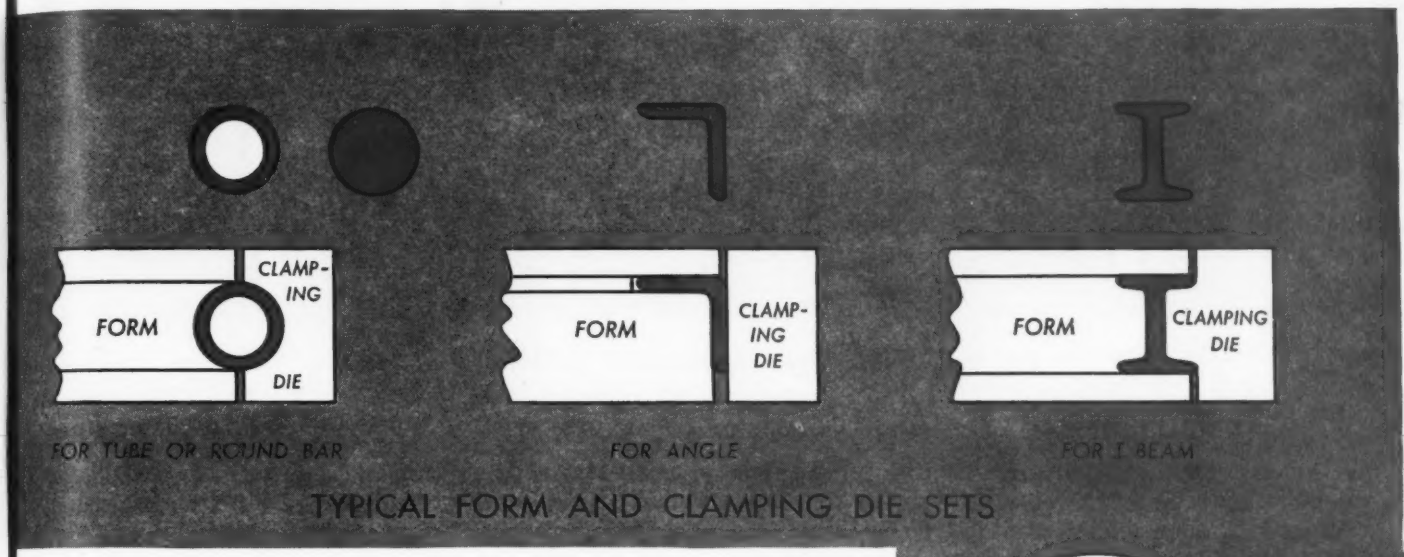
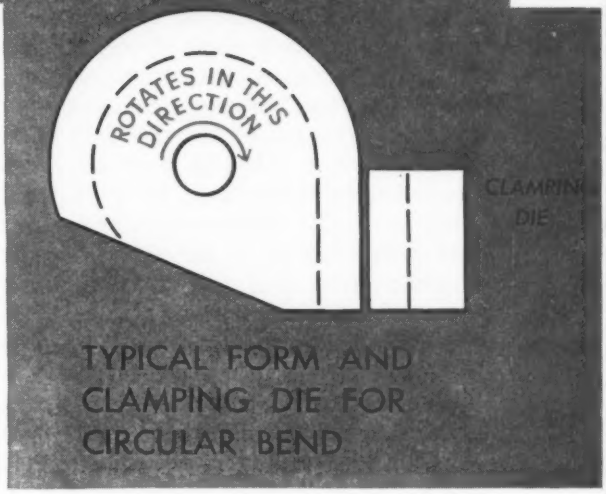


Fig. 1. The Form Should Fit the Material to be Bent as Closely as Possible



the material rolls over it rather than passes it by a sliding action. This obviously reduces friction considerably. Or, again, the pressure die may be just a plain back-up bar, so long as it fulfills the function of restraining the free end of the bent material.

Mandrels Used in Bending Hollow Sections

Mandrels are often used in bending hollow sections, like pipe. Their object is to prevent the collapse of the walls of these sections while bending. They may be of several types. The original internal supports, as was noted in the article in April MACHINERY, filled the whole length of the bend. Sand tightly packed and sealed into the section to be bent, or a coil spring which approximately fitted into the inside of the section, was, and still is, used; but the filler method is, as a rule, employed only on very light-walled sections.

The usual filler material today is an alloy metal which melts at a low temperature, approximately 170 degrees F. The molten alloy is poured into the section before the latter is bent, so that it completely fills the hollow. It is then allowed to cool before the bending takes place. By heating the bent piece, the alloy is melted and allowed to run out, and the part is cleaned inside from any metal that might remain. Excellent results are being obtained by this method.

The most common type of mandrel is that used on rotary bending machines. It may be constructed in various ways, as shown in Fig. 2. Generally speaking, the simpler mandrels are used for the heavier-walled sections which need less support. The multi-ball mandrel is designed for light-walled sections, so that the balls are able to go around the bend and provide protection against wall collapse beyond the critical area of the bend. The balls are pivoted, so that the mandrel can be removed from the finished bend by withdrawal of the straight part of the mandrel. In all cases, the size of the mandrel should be nearly the same as the inside of the section being bent, so that maximum support of the wall is obtained. There should, however, be enough clearance so that the pipe can easily slip on and off the mandrel when loading or unloading the machine.

The position of the mandrel with respect to the other bending tools is very important. Experience has shown that the front of the mandrel should always be a little forward of the point where the material begins to bend. This means that the mandrel tip actually extends into the bent portion of the pipe. It is only by this adjustment that the mandrel will furnish adequate support to the out-

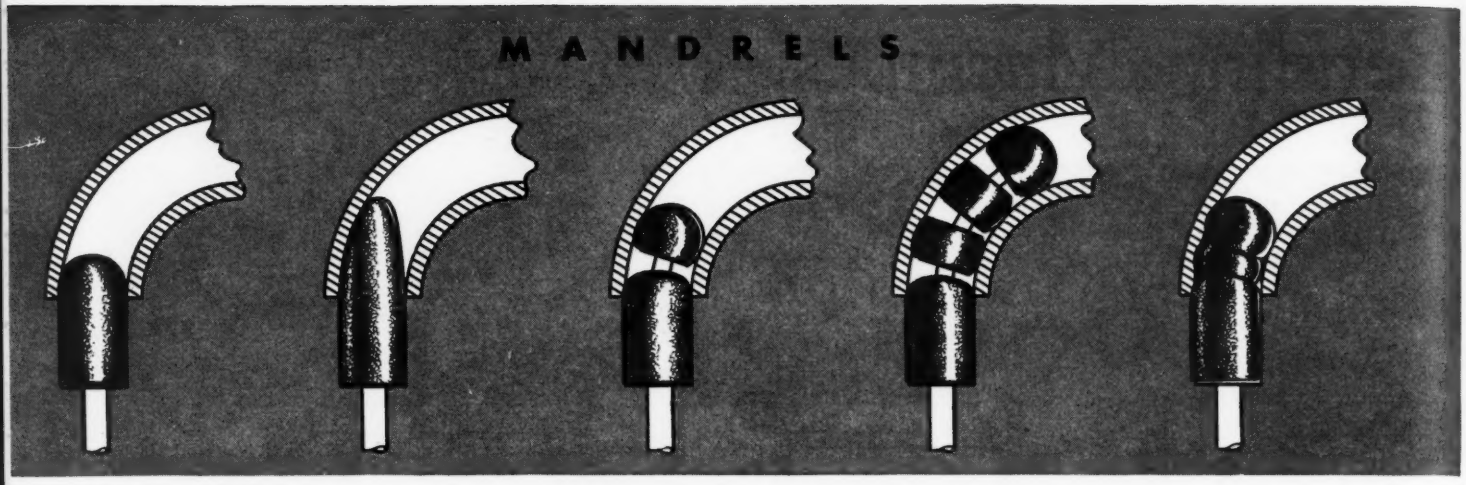


Fig. 2. Different Types of Mandrels for Pipe Bending

side wall of the section. The amount that the mandrel should extend beyond the beginning point of the bend depends on the size and type of the material, its hardness, and the radius of the bend.

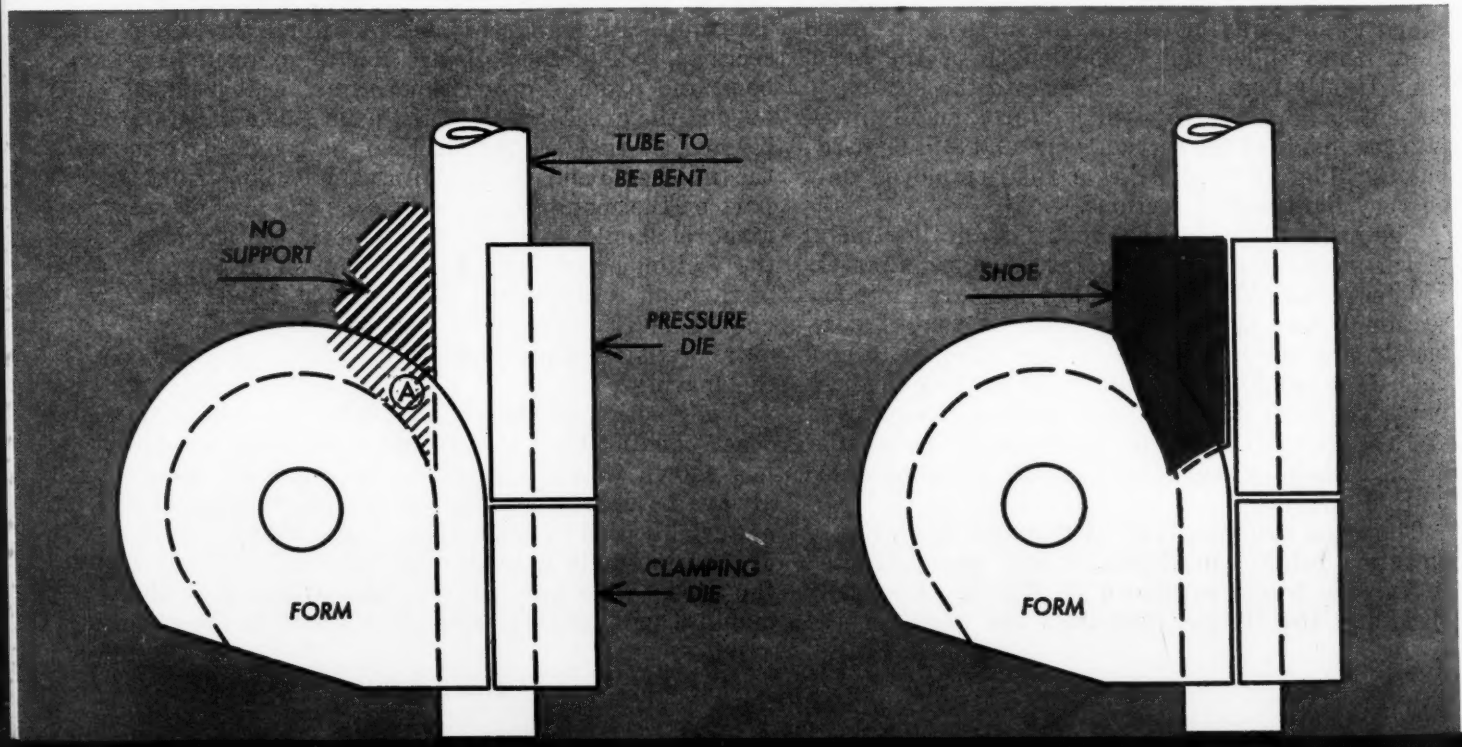
It is good practice in using a new bending machine to keep a record of the mandrel position on all bends made, so that this data may be available for use later in making other bends on the machine. It is important that the mandrel be tightly held by its support, so that it will not move out of this predetermined position. Of course, it is the responsibility of the machine manufacturer to provide sufficient stiffness in the mandrel-supporting mechanism so that this will not give in service.

The Use of Shoes in Pipe Bending

The use of a shoe is sometimes, though not always, required in pipe and tube bending. Fig. 3 shows a pipe and tools set up ready for bending on a rotary machine. In this type of bending, the entire strain or pull of the operation is acting on the material at the point *A* where bending begins, and this pull is, of course, transmitted through the material to the part directly behind *A*. On one side behind the point *A* the pressure die prevents distortion of the material, but on the opposite side the material has not yet made contact with the inside shape of the form. If the wall of the material is thin, it cannot withstand the pull on this unsupported side without distortion, and it has a tendency to buckle and wrinkle.

The shoe is designed to fit this unsupported area and extends right up to the form, as shown in the right-hand view Fig. 3. In this way, the material is supported on both sides when the bend takes place. The shoe, like the pressure die, is subject to rubbing as the material being bent passes over it, and is therefore always made of an abrasion-resisting material.

Fig. 3. The Use of Shoes in Pipe and Tube Bending



No attempt has been made in this article to describe special designs of tools. Special types of bends require special types of tools. An understanding of the fundamental principles involved will, however, enable a bending machine operator to recognize the need for special tools when they are required. Subsequent articles in this series will discuss the hydraulic circuit for tube-bending machines, and factors to be considered in designing work for bending.

Job Evaluation Methods Discussed at the A. S. M. E. Spring Meeting

AMONG the numerous papers read before the national spring meeting of the American Society of Mechanical Engineers at Chattanooga, Tenn., early in April, was one on "Job Evaluation," by Eugene Benge, president, Eugene Benge Associates, Chicago, Ill., which very clearly set forth the basic principles of the two most generally employed methods. These are the factor comparison method and the job comparison method.

The Factor Comparison Method

Job evaluation undertakes by scientific job study, and comparison, to determine the relative values of jobs within the limits of the existing wage scale. The factor comparison method of achieving job evaluation does systematically what employes themselves usually do in an unsystematic fashion. Many an employe, when seeking a raise, cites the skill required for his job as against some other job which is more highly paid; or he may cite responsibilities or working conditions or physical effort. Since this is essentially what the factor comparison method does, it appeals to employes as fair and understandable.

Jobs are generally analyzed and compared according to the following five factors:

1. Mental Requirements—education, intelligence, technical knowledge, fluency, mathematics, etc.
2. Skill—manual dexterity or skill acquired mainly through practice and experience.
3. Physical Requirements—the kind and duration of muscular effort; age, sex, height, weight, eyesight, etc.
4. Responsibility—for equipment, tools, materials, money, savings, public contact, and for the work of others.
5. Working Conditions—illumination, atmosphere, hazards, noise, etc.

Preparing a Key Job Scale

A careful job analysis is made, generally by interviewing employes, and the job specification is prepared. This specification is divided into the five factors listed in the foregoing, with appropriate subdivisions.

The factor comparison method gets its name from its method of operation. For instance, the mental requirements of each job are compared against the mental requirements of selected key jobs, and this procedure is followed for all five factors of every job.

Obviously, the crux of the method lies in the preparation of the job comparison scale of key jobs. At the outset ten or fifteen possible key jobs are selected, representing all levels of difficulty and all major departments. These tentative key jobs are intensively analyzed, and through a detailed procedure of ranking them in the five factors given in the foregoing, and of apportioning wage rates among these five factors, a job comparison scale is finally prepared.

The Job Comparison Method

In the job comparison method of job evaluation, a certain number of key jobs are selected—jobs as to the value of which there is little difference of opinion. The other jobs in the factory are then evaluated with relation to these key jobs and a comparison scale prepared. Several members of a committee each prepare a job scale, and then a comparison between the various scales usually produces an average scale that is not far from an accurate evaluation of the various jobs.

Other Papers Read before the Meeting

There were also sessions at the meeting on hydraulics, process industries, prime movers and power, metals engineering, aviation, railroad engineering, management, fuels, and education and training for the industries. Among the papers read that were of special interest in the machine-building and shop-operation field may be mentioned the "Metallurgy of Meehanite," "Developments in Metal Fabricating," "Welding of Locomotive Boilers," "Failure in Tube Sinking" (die drawing of tubes without internal supporting mandrel), and "Post-Collegiate Engineering Education in Industry."

A most instructive and clearly presented paper on nuclear (atomic) energy was read by W. G. Pollard, professor of physics at the University of Tennessee. The discussion made it clear that we are still some distance from the time when atomic energy will prove practicable for producing power for industry.

A. S. T. E. Exposition in Cleveland Was Highly Successful

THE New Era Exposition sponsored by the American Society of Tool Engineers, held in the Cleveland Public Auditorium April 8 to 12, will be remembered by manufacturers and engineers in the machine building industry as an inspiring tribute to the ability of the nation's tool designers and the skill of its toolmakers which played so vital a part in winning the war. With the opening of this first post-war exposition of the Society, there were displayed for the first time many new war-time developments in gages, tools, materials, and equipment, which are now available for use in winning a real world peace through the production of those things most needed to raise the standard of living throughout the world.

More than 250 companies participated in the exposition. Although admission was by invitation only, the attendance exceeded all expectations and far surpassed that of any of the previous expositions of the Society.

The annual meeting of the American Society of Tool Engineers, held in conjunction with the exposition, comprised nine technical sessions covering a wide range of topics. Among the subjects dealt with were plant lay-out and materials handling, new techniques in cutting tools, tooling for permanent molds, cutting fluids, controls and drives for special machines, economic control of quality, tool engineering and profits, and tool engineering education and professional development. Many outstanding engineers and manufacturers were among the speakers who appeared on the program; included in these were Ralph E. Flanders, president of the Jones & Lamson Machine Co., and A. G. Bryant, vice-president of the Cleereman Machine Tool Co., both of whom spoke on the economic aspects of tool engineering.

A most unusual paper was that presented by Otto Ewart, plant manager of the Ordnance Division of the W. F. & John Barnes Co., Rockford, Ill., who described what has been called an "automatic manufacturing plant." With the assistance of a motion picture, he showed how shells were made by continuous automatic methods at an extremely high rate of speed. (This plant was described in MACHINERY, February, 1946, page 148.)

The manufacture of German precision cutting tools and gages during World War II was dealt with in a paper by A. H. d'Arcambal, vice-president of the Pratt & Whitney Division Niles-Bement-Pond Co. The scarcity of certain metals forced the Germans to carry on experiments in many directions. In the same session, J. F. Allen, project engineer of the Warner & Swasey Co., covered recent experiments on single-point turning with carbide tools.

Inspection methods, and tools and gages used for inspection, were covered in four papers in the session on economic control of quality. Paul V. Miller, manager of the Small Tool and Gage Division of Taft-Peirce Mfg. Co., dealt comprehensively with types of gages and their application. Statistical quality control was explained by J. G. Manuele, director of quality control of the Westinghouse Electric Corporation, while many important points on quality production were outlined by Edward S. Marks of the Pratt & Whitney Division of United Aircraft. A basic study of the subject of inspection was introduced in the paper "Fundamentals of Inspection Procedure," read by Alfred L. Davis of the Rochester Institute of Technology.

A comprehensive review on the testing of cutting fluids was presented by D. J. Wangelin of the Pure Oil Co., while W. H. Oldacre, president and general manager of the D. A. Stuart Oil Co., in his usual informative style, told the tool engineers what they should know about cutting fluids.

At the annual dinner of the American Society of Tool Engineers, George T. Christopher, president of the Packard Motor Car Co., who made the principal address, referred to the tool engineer as the "middleman of technology" and outlined in an impressive manner the important work done by the tool engineers during the war. On the same occasion E. W. Hancock, works general manager, Rubery-Owen & Co., Ltd., England, acting as a representative of the British organization of tool engineers, spoke on some of the difficulties encountered and surmounted in Great Britain during the early days of the war. At the conclusion of his talk he presented the American Society of Tool Engineers with a replica of the Coat of Arms given to the British organization in recognition of the accomplishments of the British tool engineers during the war.

In addition to the technical sessions, motion pictures were shown each day of the exposition in the Public Auditorium. These films portrayed recently developed industrial processes. Tours through outstanding manufacturing plants in the Cleveland district were also conducted daily during the show. These plant visits were unusually well attended.

* * *

According to the book "Steel in the War," a "stratosphere gun," developed by the Army to protect ground troops from the enemy, was superior to any other such gun in the world. It could fire a 50-pound, 120-millimeter shell 60,000 feet in the air—that is, nearly twelve miles, or higher than enemy planes could fly.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Acme-Gridley Single-Spindle "Chuck-Matic"

A single-spindle automatic chucking machine that is radically different in design from other machines of this classification has been developed by the National Acme Co., 170 E. 131st St., Cleveland 8, Ohio. This machine is especially adapted for straight, internal, or taper boring; form turning or form boring; external turning; forming; facing; and chamfering. In designing the machine, particular attention was paid to the following considerations —the use of carbide tools; high-production work; short-run operations; high cutting speeds and feeds; and inexperience, fatigue, and safety of the operator.

With better control of set-up time as an aim, a single chuck holds the work; only two slides need to be tooled; the slide tools are mounted in the most accessible positions; the machining cycle can be instantly interrupted for resetting tools during set-up by pushing a lever to stop the feed and a second lever for reversing the movement of the slides; and finally, cams that control working and clearance cycles of tools are conveniently located.

The machine requires little effort or skill to operate. A cycle consists of (1) loading the work, the chuck jaws being opened by depressing a foot-pedal near the front edge of the pan and closed again by releasing the pedal; (2) starting the spindle by operating a safety locking-spring plunger with the left hand and a lever with the right; (3) withdrawing the slides, stopping the spindle, and cutting off the coolant flow, all of which are accomplished automatically when the cut is finished; and (4) unloading the work, the foot-pedal being depressed after the slides have been retracted and the spindle stopped. As the chuck jaws are opened and closed by air power under the control of a foot-pedal, practically no physical effort is required to operate the chuck.

The stubby, compact frame is designed to absorb the forces developed when taking high-speed cuts in tough alloy materials at heavy feeds with all-carbide tooling. The cutting tools are mounted on the compound slide and the cross-slide, which are positioned opposite each other. The compound slide, on the right-hand side of the machine, carries the tools for straight or taper boring, form turning, drilling, reaming, or grooving. The cross-slide, on the left-hand

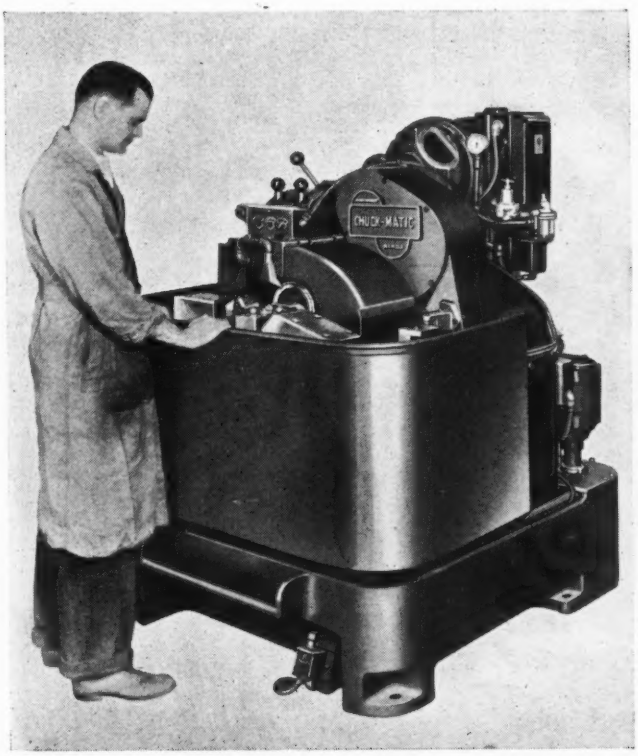


Fig. 1. Acme-Gridley Single-Spindle "Chuck-Matic" which is Designed Especially with a View to the Use of Carbide Tools

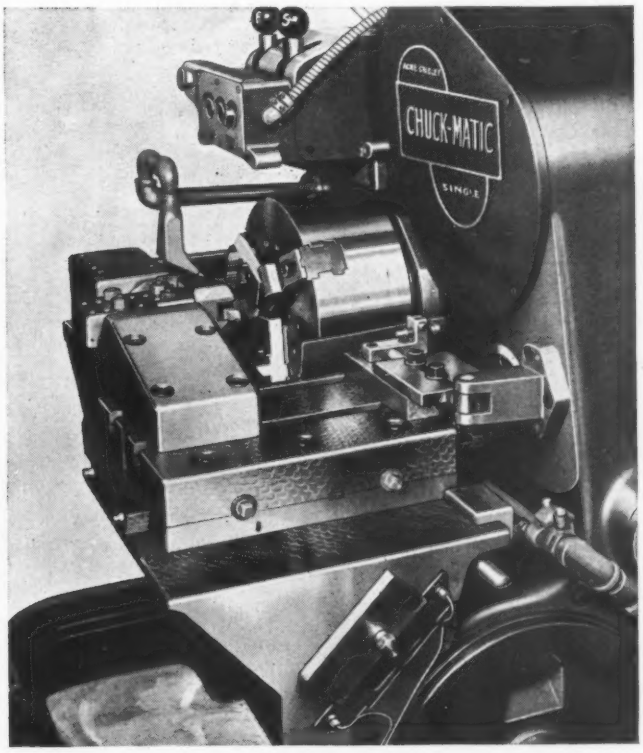


Fig. 2. Both Compound Slide and Cross-slide of "Chuck-Matic" are Arranged for Rapid Traverse to Work and Slower Cutting Feed

To obtain additional information on equipment described on this page, see lower part of page 230.

side of the automatic, carries the tools for forming, turning, facing, and chamfering. Both slides approach the working position at high speed and are slowed down to a working speed at the start of the cut.

Spindle speeds ranging from 143 to 524 R.P.M. are available through change-gears, and these speeds can be doubled by changing the motor pinion and driving gear. The machine measures 45 inches wide by 64 inches long by 64 inches high, and weighs 7350 pounds. 61

Cincinnati Monoset Cutter and Tool Grinder

Cutters that require the grinding of convex or concave surfaces to given radii, and that have straight, tapered, or helical teeth, can be quickly resharpened or ground from the solid without the use of special attachments on the new Monoset cutter and tool grinder brought out by the Cincinnati Milling Machine Co., Cincinnati 9, Ohio. This grinder can be used for conventional resharpening of end-mills, reamers, counterbores, form cutters, and a great variety of special tools, including drills of special sizes. It is particularly useful in grinding special or "problem" cutters, and will handle most cutter grinding jobs with a single chucking.

The work-head can be swiveled through an angle of 235 degrees, adjustable stops being provided to limit its arc of travel. An adjustable transfer slide provides for the accurate grinding of radii that have their centers offset from the center line of the work. A built-in spiral lead mechanism with graduated dial provides means for generating right-hand or left-hand spirals having leads as short as 1 13/16 inches, the various leads being selected by a single simple adjustment.

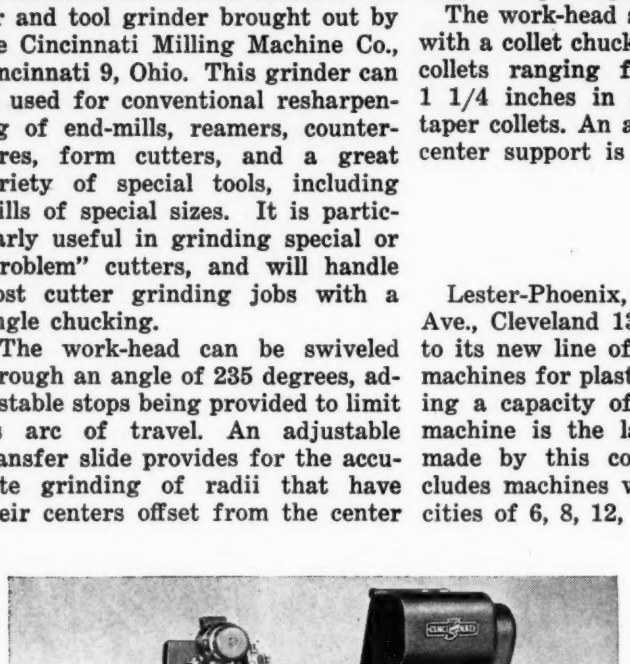
The work-head spindle is provided with a collet chuck, thirteen straight collets ranging from 1/8 inch to 1 1/4 inches in diameter, and six taper collets. An adjustable tailstock center support is provided for centered work, and adjustable spring-tensioned stock supports for work without centers. Cylindrical grinding is made possible by the work-head spindle motor drive.

The grinding-wheel spindle is supported by three sliding elements which permit it to be moved longitudinally, transversely, and vertically. The handwheel control for each slide is provided with a micrometer dial for accurate positioning of the grinding wheel, and all slides have adjustable micrometer type stop-dogs. A two-speed drive for the grinding-wheel spindle assists in maintaining the correct cutting speeds with wheels of different sizes. A high-speed spindle attachment for small mounted wheels provides a means of performing accurate internal grinding operations. All sliding elements are lubricated by a "one shot" lubricating system. 62

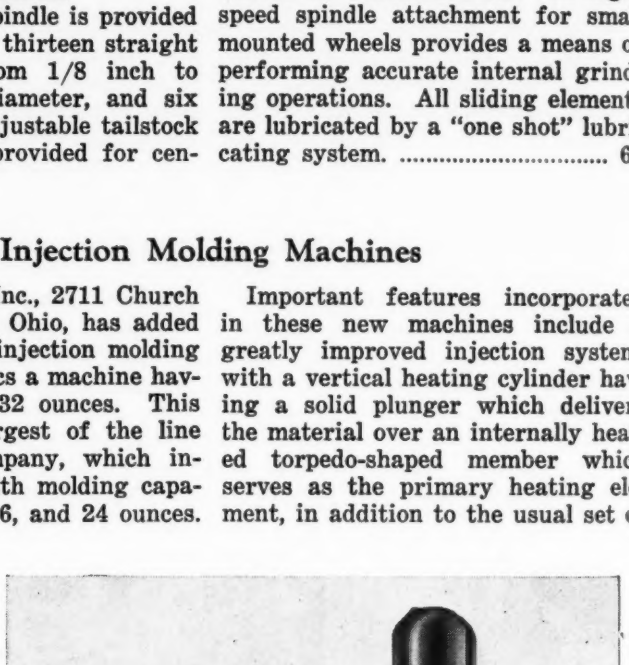
Injection Molding Machines

Lester-Phoenix, Inc., 2711 Church Ave., Cleveland 13, Ohio, has added to its new line of injection molding machines for plastics a machine having a capacity of 32 ounces. This machine is the largest of the line made by this company, which includes machines with molding capacities of 6, 8, 12, 16, and 24 ounces.

Important features incorporated in these new machines include a greatly improved injection system, with a vertical heating cylinder having a solid plunger which delivers the material over an internally heated torpedo-shaped member which serves as the primary heating element, in addition to the usual set of



Monoset Cutter and Tool Grinder Made by the Cincinnati Milling Machine Co.



Lester-Phoenix Injection Molding Machine Developed for the Molding of Plastics

To obtain additional information on equipment described on this page, see lower part of page 230.

three external resistance type heaters; and a control instrument for each heating element which provides maximum plasticizing capacity and flexibility of control. Resistance to material flow is minimized in the vertical injection system, which delivers more material into the mold at higher pressure with a given energy input than previous types of injection cylinders. The entire injection system can be swung out quickly for inspection, cleaning, and replacements.

A one-piece box type cast-alloy steel frame is a feature of these new molding machines. The newly designed powerful toggle linkage, with metal-to-metal mold locking and with the mold positively supported at all four corners, is designed to speed up mold opening and closing and to eliminate flash. Increased die space and provision for restricting the die movement as desired serve to cut the cycle time to a minimum. A larger mold adjusting screw, operated by a single hand-crank, provides for rapid adjustment of the die or mold height.

Means for hydraulic ejection of the work after the mold is fully open is regularly provided on the 16-, 24-, and 32-ounce machines, and is optional on other sizes. A special metal-flow control circuit is now standard equipment on all but the smallest models. The new Lester safety gate is interlocked hydraulically, electrically, and mechanically to insure safe operation. 63

All-Position High-Tensile Electrodes

The Metal & Thermit Corporation, 120 Broadway, New York 5, N. Y., has added two new groups of high-tensile arc-welding electrodes to the Murex line. There are eight electrodes in all, four for use on direct current with reverse polarity, and a companion electrode for each having a coating designed for use on alternating current or on direct current with straight polarity.

These electrodes provide a wide range of mechanical properties, making it possible to select weld metal closely matching many high-strength steels in tensile strength and ductility. In addition, the all-purpose feature and the two types of coating provide the versatility required to meet a variety of working conditions. The electrodes depend for their mechanical properties on graduated alloying contents of chromium and molybdenum. 64

"Turbojector" Production Molding Machine Built by Hydraulic Press Mfg. Co.

H-P-M Turbojector Molding Machine

A machine of radically new design for production molding of both natural and synthetic rubber, known as the H-P-M "Turbojector," has been added to the line of the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. This machine has a motor-driven screw which injects rubber into a hydraulically clamped mold, the entire machine cycle being accomplished automatically. The base of the "Turbojector" is a completely self-contained unit which encloses the pumps and valves for controlling all hydraulic equipment. The only connections required to put the machine in operation are those to the electric power and cooling water systems.

This machine is designed for molding a wide variety of mechanical parts. Typical examples are ring type gaskets, rubber bushings, and automobile motor mountings. The driving mechanism of the injection unit consists of a 10-H.P. four-speed electric motor and a train of gears directly connected to the injection screw. The rubber, in strip, pellets, or rod form, is carried into the injection cylinder by the feed-screw. The feed-screw meshes with a set of specially designed, free-running baffle gears which act as pressure locks, forcing the rubber into the nozzle. The frictional heat produced in the injection chamber alone raises the temperature of the rubber as high as 300 degrees F. Additional heat is secured at the nozzle by employing an electrical resistance band heater. This preheating arrangement is said to account for the rapid curing cycles obtained with this machine.

Maximum nozzle contact pressure during injection is approximately 6000 pounds, permitting injection pressures as high as 18,000 pounds per square inch on the material to be molded. The entire injection unit is pivoted on the stationary mold clamp platen and is hydraulically tilted, thus permitting the nozzle to engage the mold only during injection. To facilitate changing molds, the injection head can be hydraulically tilted clear of the mold space. This machine has molded up to 8 pounds of rubber per "shot." 65

Face Milling Cutter with Solid Carboloy Blades

A face milling cutter using solid Carboloy blades is a recent development of the Super Tool Co., 21650 Hoover Road, Detroit 13, Mich. This

To obtain additional information on equipment described on this page, see lower part of page 230.

cutter is so designed that only one type of body is required for machining any kind of material, the only variation necessary for cutting different materials being in the angles ground on the blades. Simple jigs are obtainable to facilitate sharpening the carbide blades.

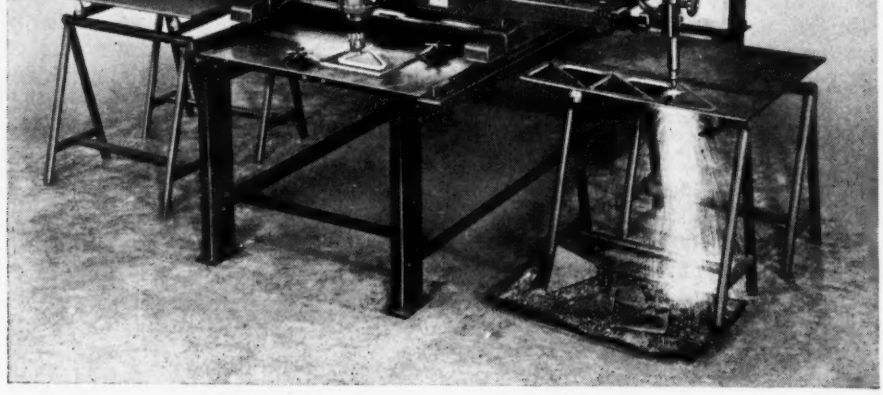
This tool permits the use of unbrazed carbide metal, which is said to have a long regrind life, as well as better resistance to cracking, chipping, and breakage. The carbide blade is held in the holder by a wedging device which permits adjustment for wear. 66

Oxweld Shape-Cutting Machine

The first post-war model Oxweld oxy-acetylene shape-cutting machine, designated CM-15-36, has been announced by The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York 17, N. Y. This machine has been designed for precision cutting on work of intermediate size, formerly handled only on large machines. A new attachment makes it possible to mount blow-pipes on both sides of the tracing table to permit cutting identical shapes simultaneously from plates on both sides of the tracing table. The attachment can also be used to eliminate "down time," since plates can be positioned on one side of the machine while cutting proceeds on the opposite side.

All types of shape-cutting performed with the larger machines are possible on this machine within its 36-inch transverse working range. The longitudinal working range for the standard table is 100 inches, but this range can be extended to any desired length by the addition of frame and table top sections.

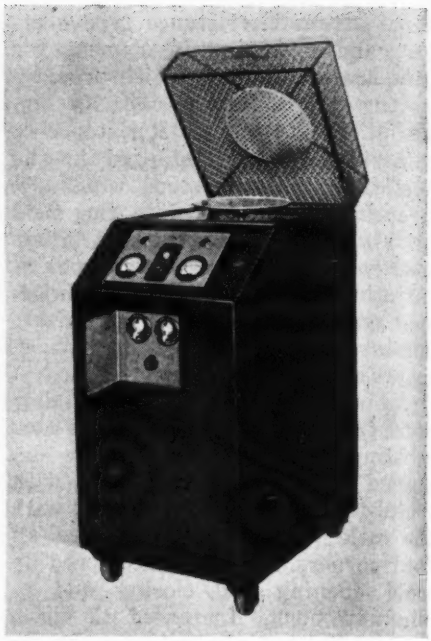
The tracing head, driven by a 110-volt universal motor, provides smooth and accurate travel of the blow-pipe. A simple speed governor furnishes an infinite variation of speed from 3 1/2 to 28 inches per minute, which is indicated on a speedometer. The machine is equipped for either mechanical tracing with strip templets or hand-tracing. A magnetic tracing unit is available for use in precision repetitive production shape-cutting. Straight-line cutting guides and an attachment for automatically cutting circles 1 1/2 inches to 36 inches in diameter are supplied with the machine. The blow-pipe holder can be tilted to an angle of 45 degrees for making bevel cuts. 67



Oxweld Shape-cutting Machine Designed for Cutting Two Identical Shapes Simultaneously

Thermall High-Frequency Heating Unit

A high-frequency heating unit known as the "Champ" has been added to the line of Thermall heating equipment brought out by W. T. La Rose & Associates, Troy, N. Y. This unit will heat 6 pounds of material to molding temperature in one minute. Preforms, powder, or other materials heated in this unit are visible at all times. The furnace is 20 inches wide by 30 inches deep, by 49 inches high, and weighs 500 pounds. It is mounted on rubber casters.



"Champ" High-frequency Heating Unit

Like all Thermall model heaters, this new unit is designed for single-control operation and is equipped with dual electrical and mechanical safety interlocking switches. Compounds requiring different time cycles can be heated simultaneously.....68

Chicago-Latrobe Stub Screw Machine Drills

In screw machine practice, where operating conditions require short, sturdy drills, it has been customary to use regular drills, cutting off a portion of the flute, thinning the web, and repointing before using in the machine. Unless extra care is taken in these operations, the temper of the drills is likely to be lowered, which will result in reducing the life between grinds.

To meet the demand for a stub screw machine drill, the Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago 10, Ill., has designed and keeps in stock a full range of wire gage drills from No. 1 to No. 60, letter sizes from A to Z, and fractional sizes from 1/16 inch to 2 inches. These stub drills are made with short flutes, and assure max-

To obtain additional information on equipment described on this page, see lower part of page 230.

imum tool life between grinds. They can also be used to advantage in hand drills and breast drills.....69

Lovejoy Improved Slotting Cutter

Sensitive control of blade settings, obtained by the addition of a screw adjustment for the blade "positive-locking" device, is the principal new feature of the redesigned Type F slotting cutter manufactured by the Lovejoy Tool Co., Inc., Springfield, Vt. As shown in the phantom view, each blade is set at a slight angle to the cutter body. When blade adjustment is required, either for resharpening or for control of slot width to close tolerances, the positive-locking device is loosened by unseating a taper pin. A recessed-head screw at the bottom of each blade is then turned to move the blade up or withdraw it the exact amount required. When properly set, the blade is positively locked in the body by reseating the taper pin.

The forged steel body of the cutter is designed to provide strength and give ample chip clearance. The deeply set blades are backed by a large column of solid steel to withstand heavy or intermittent cuts. This tool can be used for fly cutting by removing several blades.

Both positive and negative rake Type F cutters are regularly furnished in face widths of 7/16 inch to 1 1/2 inches and in diameters of 5 to 18 inches. They can be equipped with either high-speed steel or cast-alloy blades. 70

Motch & Merryweather Metal Cutting-Off and Sawing Machines

The Motch & Merryweather Machinery Co., 715 Penton Bldg., Cleveland 13, Ohio, has developed a No. 00 metal cut-off saw designed for fast and accurate sawing of ferrous bars in sizes up to 1 1/4 inches, non-ferrous bars up to 2 inches, and tubing and light-walled shapes and sections up to 2 1/2 inches. This machine, shown in Fig. 1, is available with either hand or power feed to the saw carriage, or it can be equipped with automatic cycling for both work and feed.

The general features include automatic clamping through a spring-tension cam-operated mechanism linked to the feed-lever; quick adjustment by means of movable vise jaws to suit different sizes and shapes of material; built-in coolant system; and large, accessible chip compartment. Three saw blade speeds of 160, 247, and 560 surface feet per minute are available. The main drive motor is of 1 1/2 H.P., and the coolant pump motor of 1/20 H.P. The machine requires a floor space of 20 1/2 by 29 inches, and weighs approximately 1150 pounds.

The No. 2 metal-sawing machine shown in Fig. 2 is another recent product of this company. This machine is equipped for hydraulic feeding and clamping, and is adapted for cutting ferrous and non-ferrous metal bars up to 6 inches, in round or square shapes, and for cutting standard structural I-beams in sizes up to 12 by 5 inches.

Fig. 1. Motch & Merryweather Metal Cut-off Saw

Features of this machine include positive clamping on either side of the saw blade, anti-friction headstock, single-lever control of feeding and clamping operations, positive clamping for multiple bars, and provision for fully automatic feeding of the stock.

This machine will take saw blades up to 22 inches in diameter. Four saw blade speeds are available ranging from 30 to 80 surface feet per minute. The machine is equipped with a 5-H.P. main drive motor and a 2-H.P. hydraulic motor. The variable hydraulic feeds range from 0 to

Improved Slotting Cutter with Screw Adjustment for Setting Blades, Made by Lovejoy Tool Co.

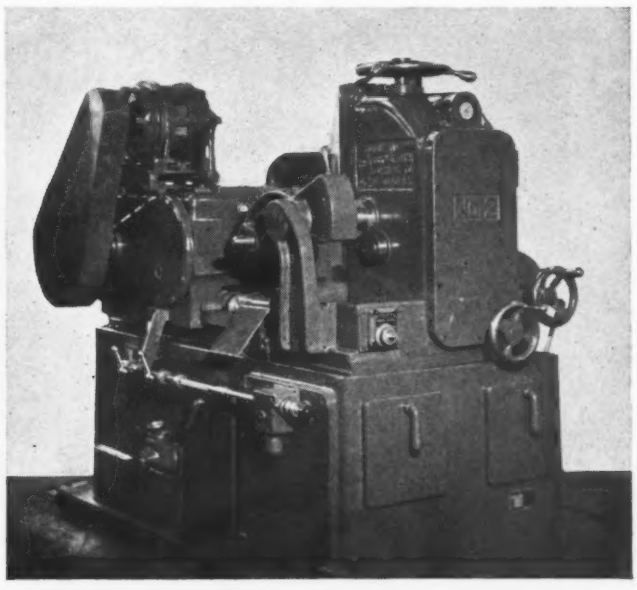


Fig. 2. Motch & Merryweather Metal-sawing Machine with Provision for Hydraulic Feeding and Clamping

To obtain additional information on equipment described on this page, see lower part of page 230.

15 inches per minute. This machine requires a floor space of 33 by 66 inches, and weighs approximately 5500 pounds. 71

Mead Pneumatic Column Press

The Mead Specialties Co., 4120 N. Knox Ave., Chicago 41, Ill., has announced a new air-operated column type press which delivers a ram pressure of 3000 pounds when operated at an air-line pressure of 110 pounds. This press is especially adapted for small or medium runs where it is desirable to leave fixtures permanently mounted on the base, as, for example, when an assembly requires several operations, each involving a different fixture.

With this column type press, successive operations can be quickly performed by simply swinging the arm over the desired fixture, raising or lowering it to the correct height by means of the elevating screw, and locking it in place with two drawbolts. In some cases, a dozen or more small fixtures can be left set up, ready for immediate use. In general, it is desirable that the fixtures be complete in themselves, so that they require only the pressure of the ram for operation. This eliminates the need of attaching dies, punches, and other tools to the ram for each new operation.

For a job requiring the cold-forming of metal, the slow squeezing action of the column press is an advantage because of the reduced tendency to fracture the metal. This is also true with respect to hot-forming of plastics, as well as many assembly jobs requiring press fits.

This machine has a height of 24 3/4 inches, a table diameter of 23 1/2 inches, and a stroke of 3 inches. It weighs 285 pounds. The maximum clearance of the ram above the table is 11 inches, and the design provides for a maximum throat depth of 4 3/4 inches.....72

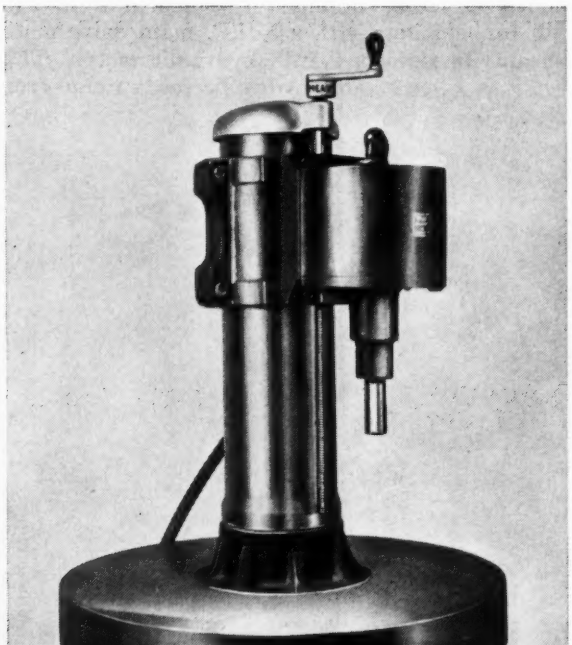
Precision Internal Grinder

A precision internal grinder having the flexibility required for grinding radii and tapers on any tool and die parts is a new product of the Superior Machine & Tool Works, 528 Butterworth St., S.W., Grand Rapids, Mich. This machine, called the JY No. 2, is especially designed for handling a wide range of tool-room work, grinding practically any piece from 1/4 inch in diameter up. It has a spindle speed range of from 12,000 to 27,000 R.P.M. and a workhead speed of 200 to 400 R.P.M. The spindle is mounted on preloaded super precision ball bearings to insure accuracy at high operating speeds.

This machine requires a floor space of only 36 by 68 inches, and has a swing capacity of 10 1/2 inches, with a longitudinal travel of 11 inches. The 10 1/2-inch faceplate, with heater controlled switches, is standard equipment. A time-saving feature is provision for measuring the work without stopping the machine. The friction drive clutch and hand-lever serve to put the machine out of gear and apply the brakes simultaneously. The grinding spindle is driven by a 1/2-H.P. motor operating at 2450 R.P.M., and the work-spindle is driven by a 1/6-H.P., 1100 - R.P.M. motor. Both motors used on this machine are dustproof and fully enclosed. 73

Walton Pipe Tap Extractors

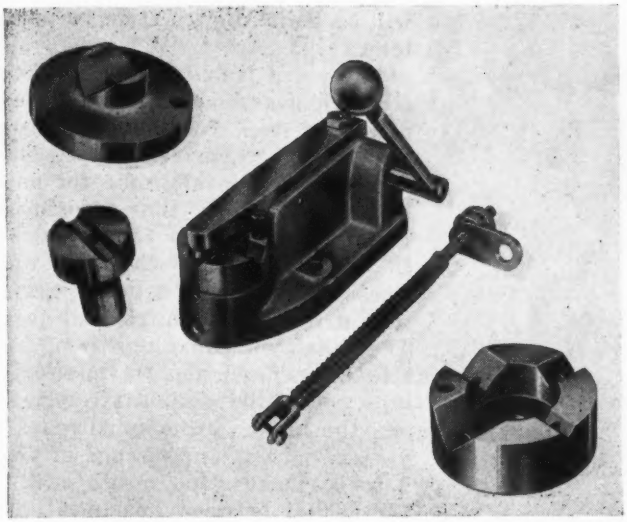
The Walton Co., 94 Allyn St., Hartford 3, Conn., has added to its line ten sizes of pipe tap extractors designed for quick and easy removal of broken pipe thread taps. These are constructed on the same principle as the Walton extractors for hand and machine screw taps. They are available for all sizes of pipe taps from 1/8 to 1 inch, inclusive, and for both regular and interrupted thread styles. 74



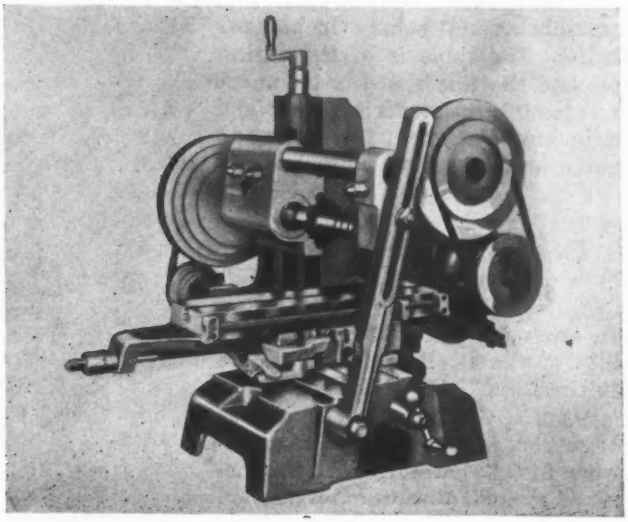
Pneumatic Column Press Brought out by the Mead Specialties Co.

Precision Internal Grinder Built by the Superior Machine & Tool Works

To obtain additional information on equipment described on this page, see lower part of page 230.



"Kam-Grip" Drill Jig with Interchangeable Anvils and Bushings to Accommodate Various Sizes of Work



Armor Milling Machine Placed on the Market by the Aircraft Machinery Corporation

"Kam-Grip" Drill Jigs

Drill jigs designed for application to short-run jobs, as well as to medium- and long-run operations, have been designed by the Manufacturers Engineering Service, Inc., 415-16 Security Bank Bldg., Toledo, Ohio. Application of the same jigs to different work has been achieved by the use of simple, interchangeable anvils and bushings. One set of accessories, for example, can adapt a jig to as many as sixteen different combinations of stock and drill sizes. Standard models accommodate round stock from 1/8 to 7/8 inch in diameter, while special models are available for larger sizes of work and may be equipped with anvils to accommodate square, flat, or hexagon-shaped stock.

By attaching a lock release rod to the arm of the jig and to the quill of the drill press on which the jig is being used, the action of the jig can be coordinated to that of the drill spindle, thereby making the operation of the jig entirely automatic...75

Armor Milling Machine

The Aircraft Machinery Corporation, Burbank, Calif., is placing on the market the Armor milling machine here illustrated, which is adaptable to a wide range of machine shop work. Designed and built to meet specifications of the aircraft industry, this machine is capable of high-speed accurate production on intricate tool work. Although only the size of a bench miller, this machine, weighing 320 pounds, has performance characteristics found only in large milling machines. It will swing work 22 inches in diameter, and small bar stock can be fed through the taper spindle. Provision is made for accurate jig boring through the use of rods and an indicator.

The hand screw feed is standard equipment, but a lever feed assembly can be used in place of the screw to change over from tool work to production milling. A fully automatic power feed is available which drives the table in either direction independently of the spindle rotation through a totally enclosed reversing gear-box. Geared power feeds from 1/4 inch per minute for high-speed milling cutters through thirty-two steps to 15 inches per minute for carbide-tipped cutters are available. These feeds are equivalent to from 0.0015 to 0.013 inch per spindle revolution.

Eight spindle speeds ranging from 98 to 1140 R.P.M. are obtained through double-belted cast-iron pulleys. The back-gear accessory provides a low spindle speed of 33 R.P.M. A motor of 1 H.P. or smaller can be used for the drive. The machine has a longitudinal travel of 12 inches, a vertical travel of 10 inches, and a cross travel of 7 inches. All three lead-screws are provided with accurate micrometer dials. Deep-throated T-slots are provided in the table for 1/2-inch bolts. A heavy-duty vertical attachment is available for this machine. 76

DoAll High-speed Band Saw Designed for Cutting Light-gage Metals, Wood, and Plastics

DoAll High-Speed Metal Saw

A high-speed sawing machine designed especially for cutting light-gage metals, wood, and plastics has been added to the line of the DoAll Co., 1301 Washington Ave. S., Minneapolis 4, Minn. This "Zephyr 16," as the machine is called, has a 16-inch throat depth and a 10-inch thickness capacity. There is an infinitely variable speed range of 1000 to 5000 feet per minute. The saw will cut through 1/8-inch stainless steel at the rate of 48.6 lineal inches per minute; No. 13 gage sheet steel at 150 inches per minute; and 75-ST

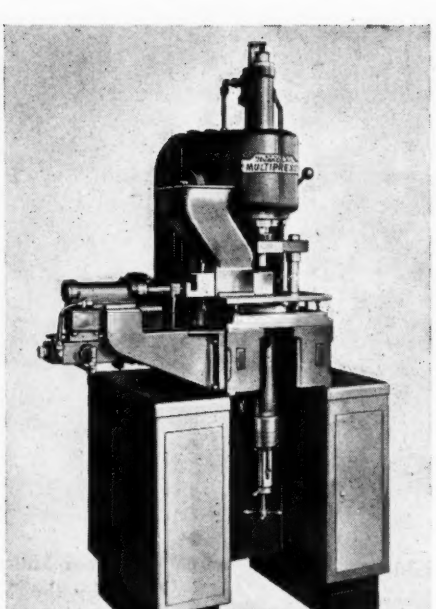
To obtain additional information on equipment described on this page, see lower part of page 230.

aluminum at 100 square inches per minute. The table is of the tilting type, and there is a disk attachment for cutting circles; a rip fence; and a mitering attachment for cutting to regular and compound angles. 77

Denison Shuttle Feed for "Multipress"

In order to broaden the scope and utility of the 4- and 6-ton hydraulic "Multipresses," the Denison Engineering Co., Columbus 16, Ohio, has brought out a new shuttle feed accessory for use on high-speed production jobs, including the production of molding-powder pellets. When either the 4- or 6-ton press is used, it is equipped with a hydraulic ejection cylinder and a hydraulic cylinder for actuating the powder feeding box, as shown in the illustration.

The press ram, ejection ram, and feeding box ram are all positively interlocked. In operation, the shuttle feed moves the filling box from the powder storage hopper over the die, deposits the powder in the die, and then retracts. Next, the pressure ram descends and forms the pellet, after which the ejection ram rises and ejects the pellet. The pellet remains on the die until brushed into the discharge chute by the shuttle feed ram as it moves the filling box into position for refilling the die.



Denison "Multipress" Equipped with Shuttle Feed

The Multipress units used in setting up a pelleting machine are equipped to provide vibratory action, which can be adjusted to give the ram up to eighteen short strokes in conjunction with each full stroke. The length of the short vibratory strokes can be adjusted from 1/32 to 1/2 inch. The ram has a maximum downward travel of 200 inches per minute, and an upward travel of 300 inches per minute. During the last 2 inches of downward movement, the speed of the ram can be reduced to 40 inches per minute. Thus, the forming punch can be made to approach the die rapidly and then slow down just as the punch is about to enter the die. 78

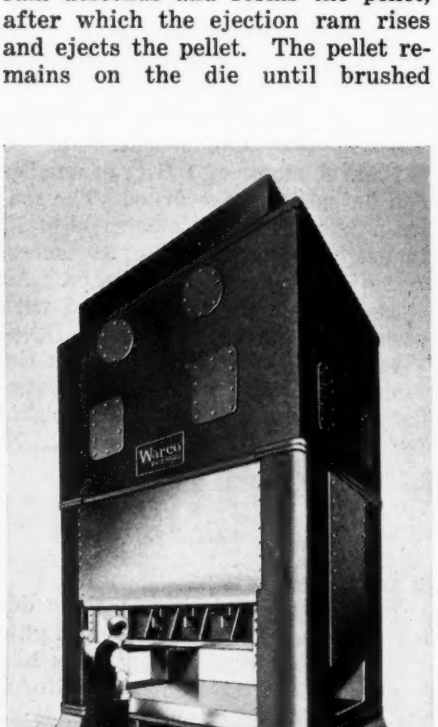


Fig. 1. Warco Two-point Eccentric-gear Press Built in Capacities of 100 to 1200 Tons

Warco All-Steel Welded Presses

All-steel welded presses of two-point eccentric-gear and open-back inclinable types are being introduced on the market by the Warren City Mfg. Co., subsidiary of the Federal Machine & Welder Co., Warren, Ohio. Presses of these types are shown in Figs. 1 and 2. The eccentric-gear models will be built in both mechanical and hydraulic types and in capacity ratings from 100 to 1200 tons, while the open-back inclinable presses will be built in sizes from 50 to 150 tons.

The press frame and slide of the eccentric-gear models are constructed of welded steel. The slide is adjusted by a motor which is equipped with a magnetic type of brake for automatically locking the adjustment. Pneumatic cylinders counterbalance the weight of the slide and dies. These presses have a double-geared twin drive with eccentric bull gears. The clutch and brake unit is of friction-disk, mechanically interlocked type, with the clutch air-operated and the brake spring-actuated. The presses have a stroke range of from 8 to 36 inches, and measure 42 to 156 inches between housings. The construction of the open-back inclinable presses is similar to that of the eccentric-gear models and the clutch and brake unit is of the same design. The inclinable presses are available with a stroke range of from 4 to 14 inches. 79

ATC Electronic Contactor

A P7 electronic contactor intended for use as a micro-positioning control on automatically fed machines, for converting delicate contact-making instruments into positive control devices, for photo-electric cell control applications, and for many other

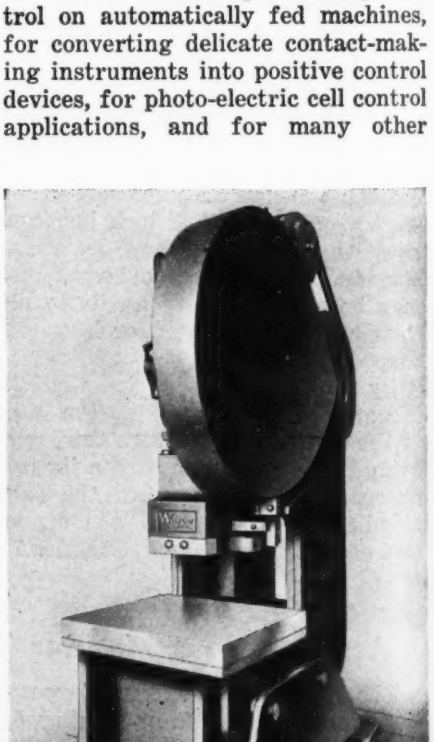


Fig. 2. Warco Open-back Inclinable Press Available in Capacities of 50 to 150 Tons

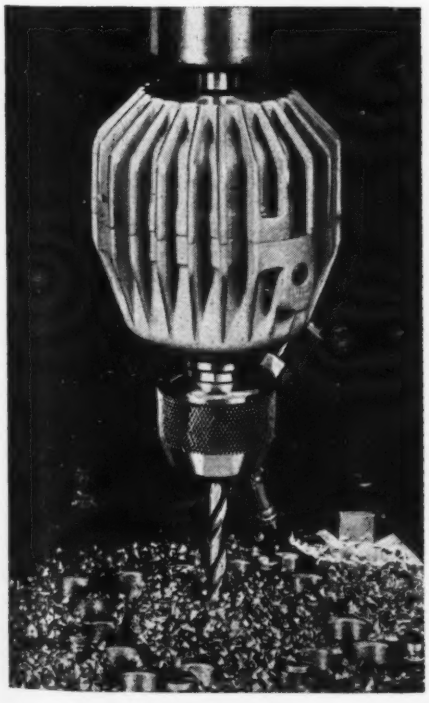
To obtain additional information on equipment described on this page, see lower part of page 230.

uses has been brought out by the Automatic Temperature Control Co., Inc., 34 E. Logan St., Philadelphia 44, Pa. This contactor is supplied at present for operation on 110-volt 60-cycle current only. One of these electronic contactors was recently applied to a production machine for the continuous automatic gaging of work as it leaves the machine. 80

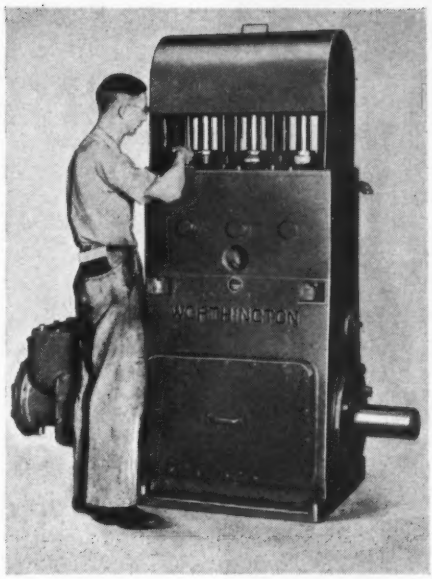
Chip-Breaker Attachment for Drilling Machine

An improved drill chip-breaker, designed to break the chip at each revolution of the drill and thus increase the operating speed and prolong drill life, is being placed on the market by the Ex-Cell-O Corporation, 1200 Oakman Blvd., Detroit 6, Mich. This unit breaks the chips into small, uniform pieces that are easily carried up the flutes of the drill. The short chips accumulate around the mouth of the hole, eliminating the long whirling spirals, which would otherwise be thrown around the machine and on the floor by the revolving drill. When a coolant is used, it flows on the work and down the drill flutes past the short loose chips to the point of the drill without splashing.

The chip-breaker can be used vertically, horizontally, or at any angle at which the housing can be held stationary while the drill rotates...81



Ex-Cell-O Chip-breaker Attachment for Drilling Machine



Worthington "Automatic Variflo" High-pressure Pump

Worthington Variable-Stroke Pump

An improved variable-stroke Triplex pump termed the "Automatic Variflo" has been brought out by the Worthington Pump & Machinery Corporation, Harrison, N. J. This pump is designed for high-pressure, stepless capacity variation from zero to maximum, and is adapted for use in the operation of hydraulic extrusion presses, stationary and marine boiler feeds, pipe-line pumping, and many other types of equipment. The pump unit illustrated is designed to be driven by a 75-H.P. motor. This "Variflo" pump is mounted in a frame of exactly the same size as the constant-stroke pump made by this company, and has the same dimensions, except for the control cylinder shown at the left of the pump.

Positive automatic pressure lubrication is furnished by a direct-driven gear type oil pump, which also provides oil pressure for the hydraulic stroke control cylinder. The stroke changing elements and other bearings are kept flooded with filtered oil. The illustration shows an operator adjusting the stuffing-box glands, which are located on top of the cylinders where they are readily accessible. 82

J & S Self-Oiling Lathe Center

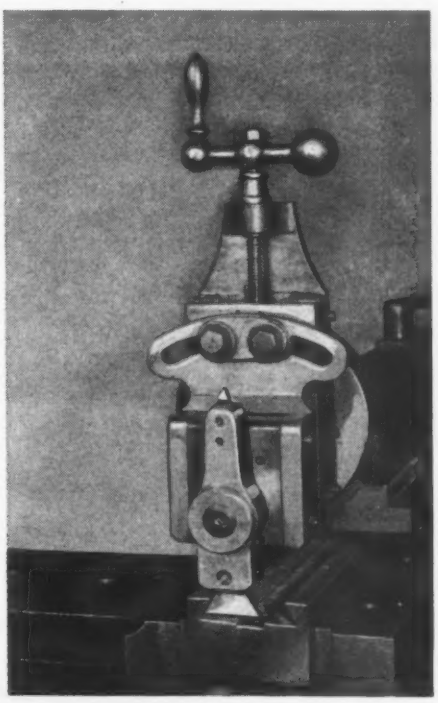
A lathe center provided with a reservoir that will contain enough oil for a day's work and will emit the oil in sufficient quantities to keep the center hole in work lubricated is being placed on the market by Jackish & Spanik, 4318 Elston Ave., Chicago 41, Ill. With this type of center, there is no necessity of applying red lead to the taper for each piece of work, and possible scoring of the work is prevented by the lubricant.

The center has a small hole in the front end for emitting the oil and a vent-hole in back that promotes the natural flow of oil to the tip. The 60-degree angle can be reground as often as on a standard lathe center. This center is available in all standard Morse tapers. 83

Combination Contour Shaper Bit-Holder

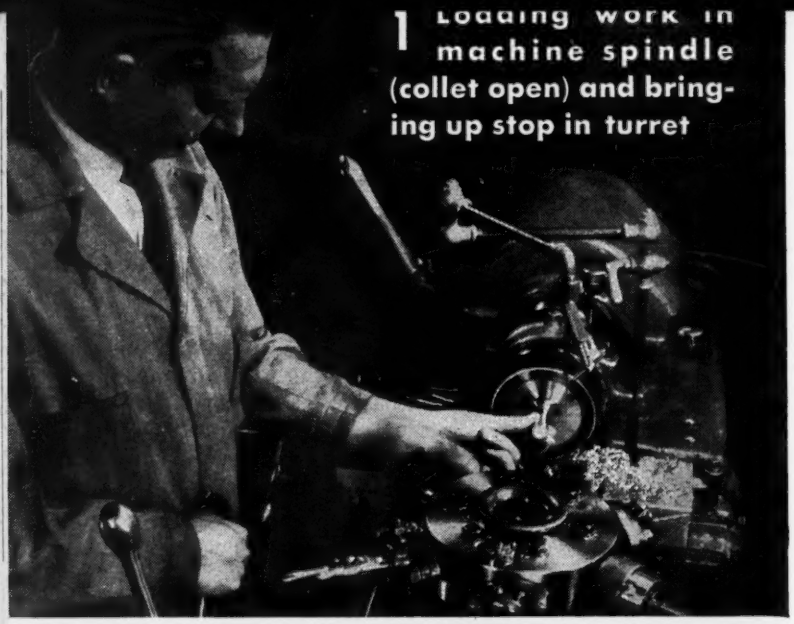
A new type shaper bit-holder designed for use in performing work ordinarily requiring five or more conventional tool-holders has been placed on the market by the All-In-One Tool Co., 865 N. Sangamon St., Chicago 22, Ill. It can be used as a straight, right-hand, left-hand, cutting-off blade, and keyway-cutting tool-holder. To speed up stock removal operations, two tool bits can be used, one mounted beside the other and extended so that it takes a cut equal to that of the first bit.

In shaping tool-steel blocks for dies, the first tool bit can be extended to take a heavier cut, while the second bit can be set for a light cut to obtain a smooth surface finish. This



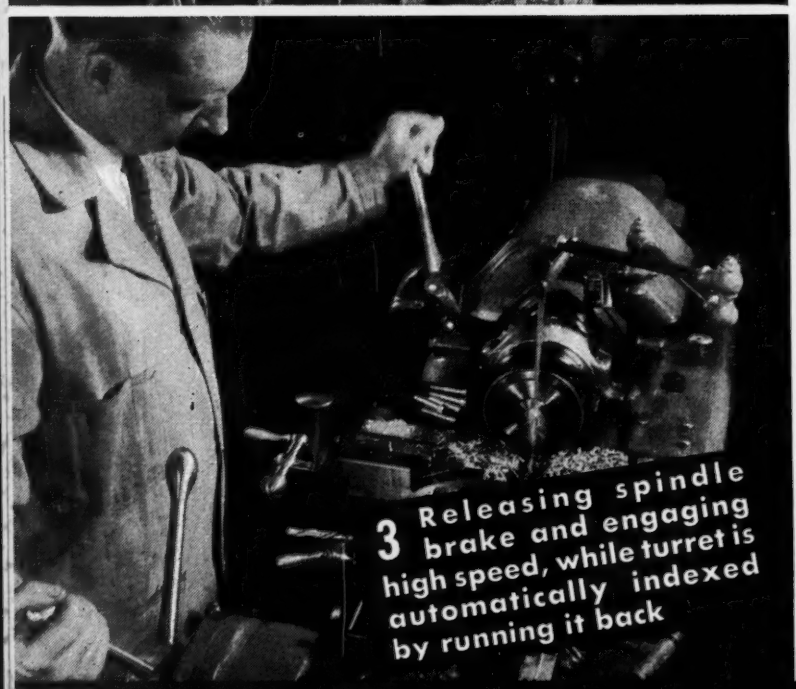
Shaper Bit-holder Made by All-In-One Tool Co.

To obtain additional information on equipment described on this page, see lower part of page 230.



1 Loading work in machine spindle (collet open) and bringing up stop in turret

2 A tap of the hand closes chuck and piece is securely held for machining



3 Releasing spindle brake and engaging high speed, while turret is automatically indexed by running it back

4 Power Feed for Tu — an attachment No. 2 Machine — is gaged for the drill operation

. . . RAPID OPERATIO WITH ON THOSE SECOND OP — Here's a typica cycle on these Profitable WIR FEED

QUICK CHANGE-OVER—simplicity of se up adjustments

SPINDLE BRAKE—integral with clutch leve

TRIP LEVER—opens or closes collet by powe

20 SPINDLE SPEEDS—ranging from 362 to 175 r.p.m. on No. 1 Machine and 2485 to 125 r.p.m. on No. 2

. . . **TOGETHER** with all the handy facili ties for completing pieces from bar stock

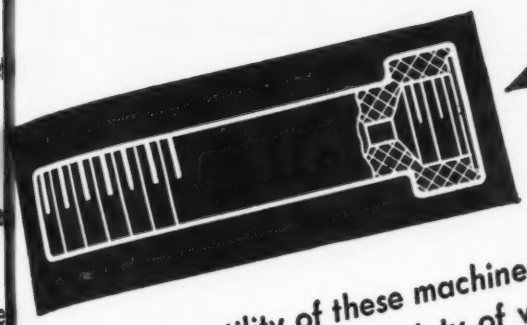
BROWN &

WITH MINIMUM EFFORT

OPERATIONS TOO!

cycle of operations

FEED SCREW MACHINES



Versatility of these machines to handle a wide variety of work and materials is profitable on **bar work,** also.

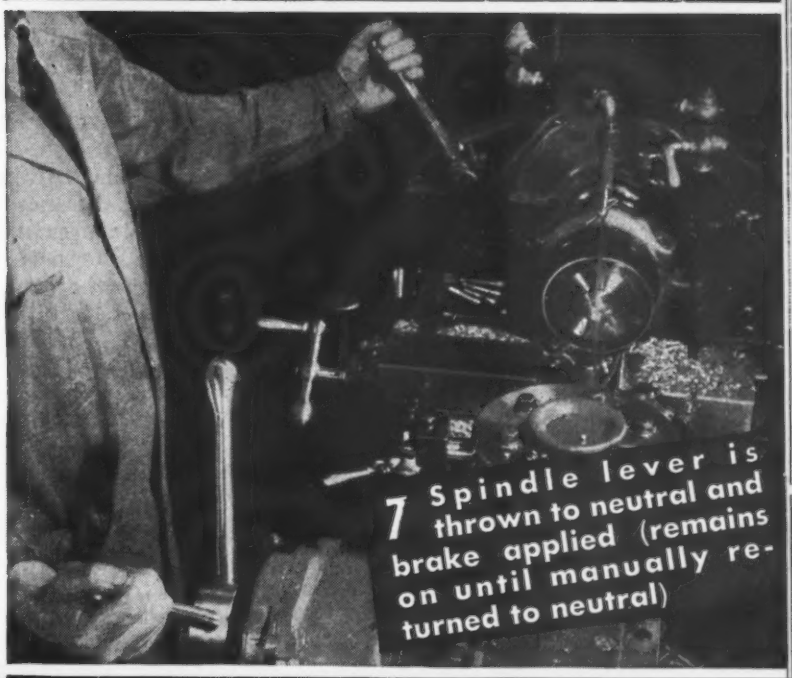
★ No. 1 Machine takes stock to ⅝" dia. (⅞" for light work).

★ No. 2 Machine takes stock to 1" dia. (1¼" for light work).

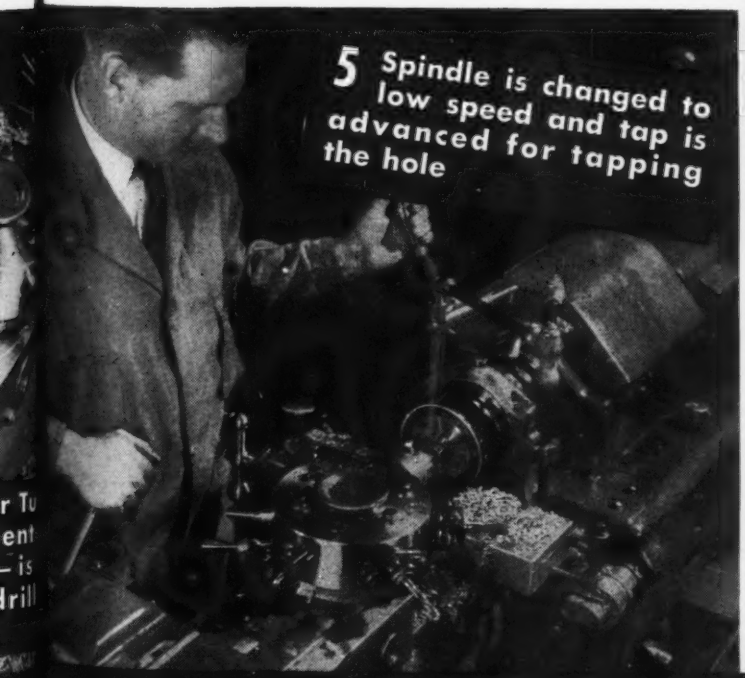
Ask for Booklet giving details

B·S BROWN & SHARPE MFG. CO.
Providence 1, R. I., U. S. A.

8 A tap on the trip lever opens the chuck and the finished piece is removed



7 Spindle lever is thrown to neutral and brake applied (remains on until manually returned to neutral)



5 Spindle is changed to low speed and tap is advanced for tapping the hole

6 Spindle lever is moved to again engage high speed to remove the tap from the work

SHARPE

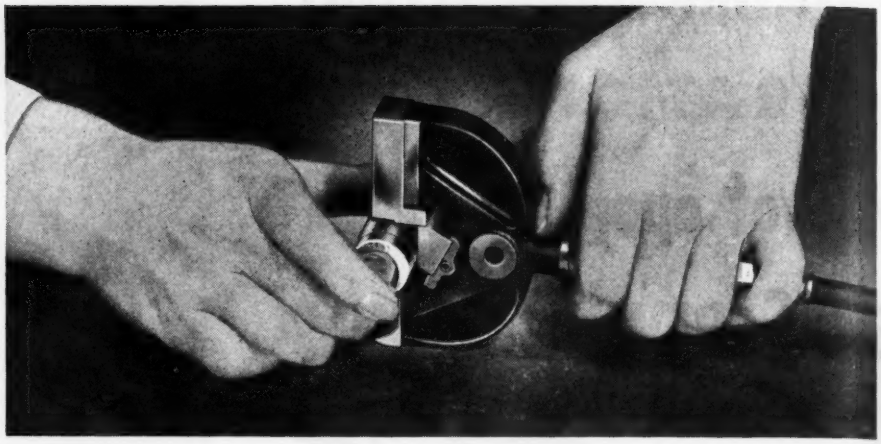
combination bit-holder can be easily adjusted to any position, and will hold cutting-off blades rigidly, the blade being supported for the entire length of the holder.

With this bit-holder, dovetails can be finished on matching parts without resetting the forming tool, so that the dovetail angles of both parts will be equal and very little scraping or fitting will be required. 84

"Airsnap" Fixtures for Use with Precisionaire Instruments

A new line of adjustable "Airsnap" fixtures, developed for use with Precisionaire measuring instruments, has been announced by the Sheffield Corporation, Dayton 1, Ohio. These fixtures have been designed for a wide range of applications in checking external dimensions of work in a machine or at the bench. They are also used advantageously on work that is too large or unwieldy to be presented to the gage and for checking close to a shoulder. Highly finished or soft-plated parts can be checked with a minimum possibility of marring or scratching, and thin-walled cylinders can be checked on the outside diameter without causing them to collapse. These fixtures are available in eight models covering a range of sizes from 0.250 inch to 2 inches.

Standard adjustable "Airsnaps" can be used with Sheffield Precisionaires on dimensions with tolerances ranging downward from 0.002 inch. Special adjustable "Airsnaps" can be used for checking to tolerances of 0.0002 inch down to ten-millionths inch. Tungsten-carbide surfaces serve to reduce the wear on the gaging anvils to a minimum. Each adjustable "Airsnap" fixture has a built-in, balanced air-flow feature, which insures uniform accuracy of readings even if one anvil is placed closer to the part than the other...85



Adjustable "Airsnap" Fixture for Use with Sheffield Precisionaire Instruments in Checking External Dimensions

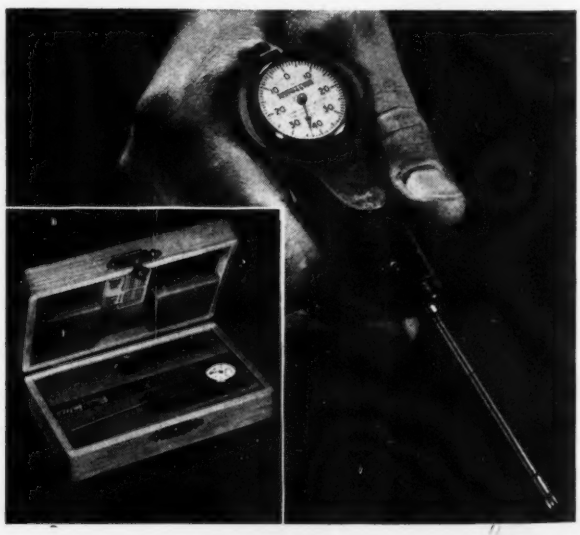
Elgin Plug Gages with Flexible Handles

The Sapphire Products Division, Elgin National Watch Co., 932 Benton St., Aurora, Ill., has brought out a flexible plug-gage handle designed to relieve the gaging member of abuse, reduce operator fatigue, and permit gaging operations to be performed with greater speed and sensitivity. The flexible feature permits the "Go" plug to enter the hole in proper alignment, even though the axis of the handle is out of alignment as much as 20 degrees when the gage is advanced to the work. The "Go" and "No Go" ends of the gage are identified by round and hexagonal nuts, respectively. 86

Federal Dial Gage for Small-Size Holes

A dial indicator gage for extremely small holes has been placed on the market by Federal Products Corporation, 1144 Eddy St., Providence, R. I. This new gage will gage holes from 0.122 up to 0.250 inch through the use of a set of twelve interchangeable gaging plugs. It will also gage these small holes to depths as great as 2 1/4 inches, indicating various irregularities such as taper, out-of-roundness, and other defects. The gage is graduated for a minimum reading of 0.0001 inch. 87

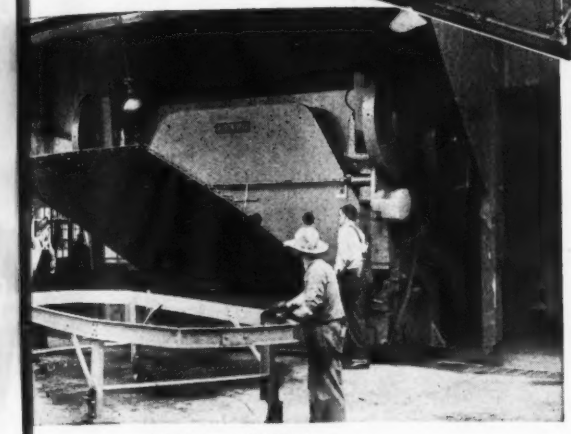
Plug Gage with Flexible Handle that can be Bent as Much as 20 Degrees



Federal Gage for Holes as Small as 0.122 Inch Diameter and up to 2 1/4 Inches in Depth

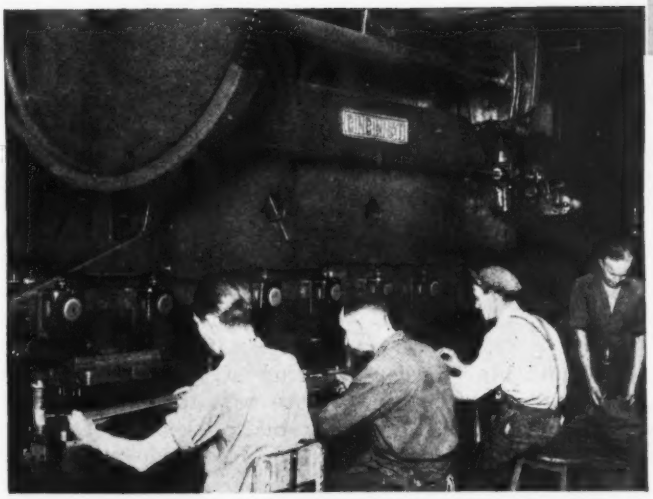
To obtain additional information on equipment described on this page, see lower part of page 230.

Use a Press Brake...

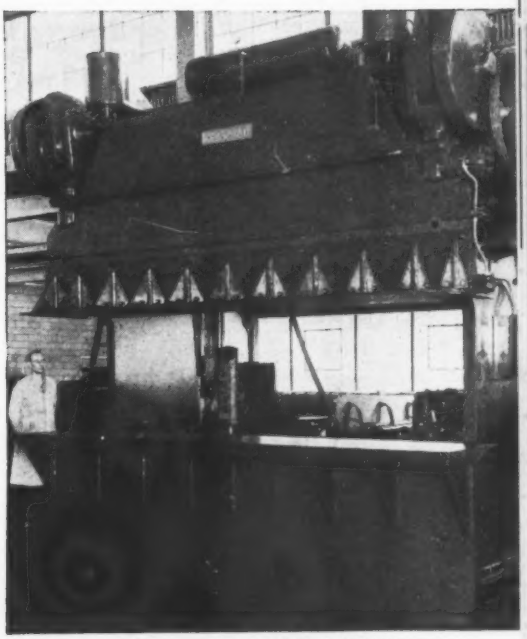


FOR BENDING

FOR MULTIPLE PUNCHING



FOR PROGRESSIVE FORMING, PUNCHING, NOTCHING



FOR PRESS WORK

Many a job is best on a Cincinnati Press Brake. This versatile machine forms, bends, corrugates, punches, notches . . . using simple low-cost dies for jobbing work, or progressive and multiple dies for quantity production.

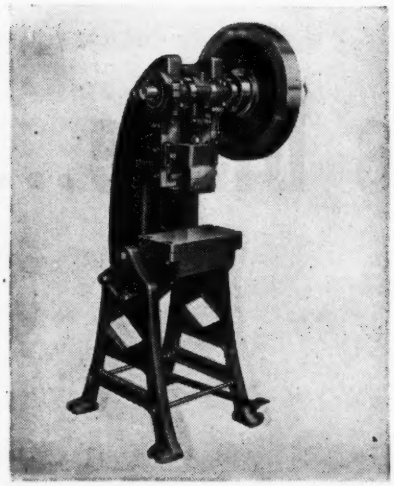
Its wide utility reduces manufacturing costs . . . its unusual accuracy pays on the assembly line . . . it's a producer of double dividends.

Write for Brake Catalog B-2.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES



Diamond Power Punch Press Available in 12- and 14-ton Capacities

Diamond Power Punch Presses

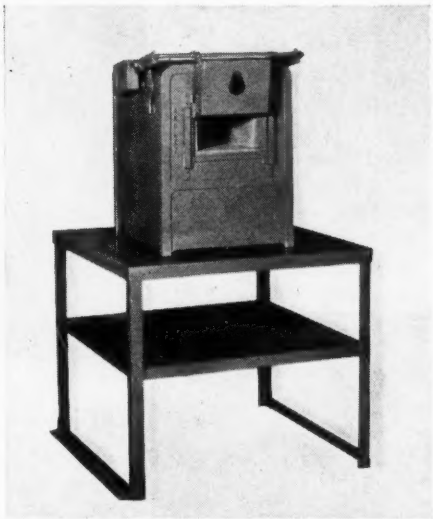
Two inclinable open-back power presses rated at 12 and 14 tons have been placed on the market by the Diamond Machine Tool Co., 3429 E. Olympic Blvd., Los Angeles 23, Calif. These presses have a 6 1/2-inch opening in the back of the frame, and will incline up to 40 degrees. The standard stroke is 1 1/2 inches for the No. 12 press, and 2 inches for the No. 14, but longer strokes up to 3 inches can be provided. These presses are compactly designed, requiring a floor space of only 23 inches square. 88

Weldex Spot-Welder

An improved bench type spot-welder has just been brought out by Weldex, Inc., 7308 McDonald Ave., Detroit 10, Mich., known as Model 263-A. This is a 3-KVA 220-volt, sixty-cycle single-phase, air-operated precision spot-welder with foot control, electronic timing, and an adjustable pressure switch. It is recommended for spot-welding lightweight cold-rolled steel up to 18 gage. This welder is 21 inches high, 10 inches wide, and 23 inches deep, and weighs 135 pounds. 89

Cooley Small-Size Heat-Treating Furnaces

The standard electric furnaces made by the Cooley Electric Mfg. Corporation, 44 S. Shelby St., Indianapolis 7, Ind., with hinged doors which, when opened, form a loading shelf, have been supplemented by an alternate design having a counterweighted vertically operated door.



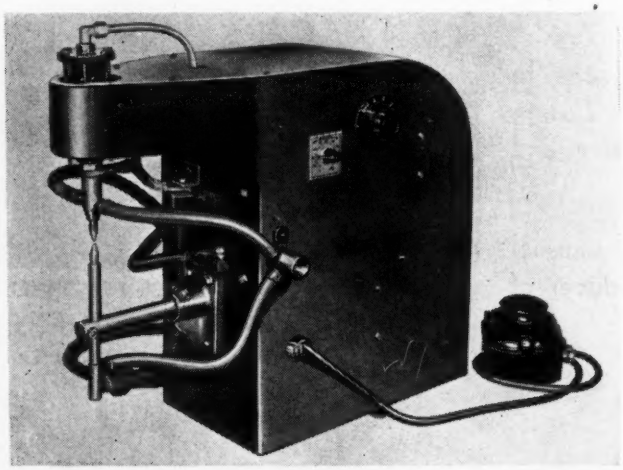
Cooley Heat-treating Furnace with Counterweighted Vertically Operated Door

Furnaces of the new design are intended for use when only partial opening of furnace doors is required. These furnaces are suitable for such industrial uses as heat-treating tools, dies, and small parts, and also for laboratory operations. They are manufactured in two standard sizes, the MH-3 having a chamber 8 inches wide by 6 inches high by 14 inches long; and the MH-4 with a chamber 10 inches wide, 6 inches high, and 18 inches long. The furnaces are designed for continuous operation at temperatures up to 1750 degrees F. or for intermittent operation at temperatures as high as 1850 degrees F.

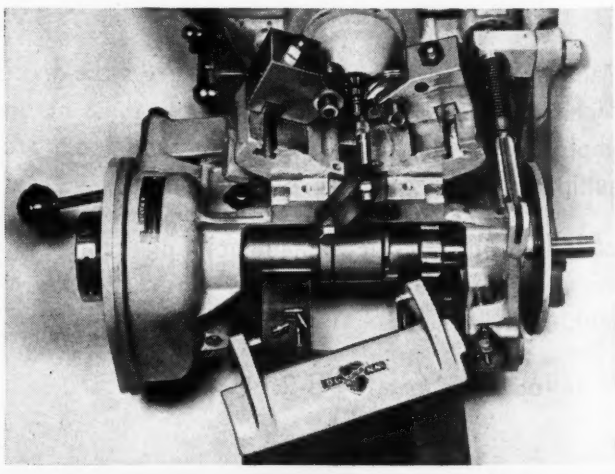
A heavy-gage welded structural steel stand is also available for use as a furnace bench. 90

"Dunamatic" Lathe Attachment

An attachment designed for application to either Atlas or Logan lathes to provide a means of producing small parts automatically has been placed on the market by the Dunn Engineering Co., 6341 Lyndon Ave., Detroit 21, Mich. This attachment employs face-cams to control the operation of rocker arms which, in turn, control form and cut-off tools attached to them. Either circular or flat form tools, or a combination of both, can be used. The rocker arms operate on pivots instead of slides, thus eliminating the necessity for frequent adjustment. The stock is cam-fed by feed-fingers through a tube and into a collet. A moving stop determines the length of the part to be formed or cut off. Automatic closing of the collet is timed to coincide with the starting of the tools. 91



Weldex Improved Bench Type Precision Spot-welding Machine



"Dunamatic" Lathe Attachment for the Automatic Production of Small Parts

To obtain additional information on equipment described on this page, see lower part of page 230.

WRITE FOR THIS BOOK . . .

NEW PRODUCTION TYPE METAL DRILLING MACHINES
21"-24"-28"
DIRECT DRIVE
SUPER SERVICE
UPRIGHT DRILLS
CINCINNATI BICKFORD TOOL COMPANY
CINCINNATI 9, OHIO, U.S.A.
Booklet U-27
NEW
METAL DRILLING MACHINES
DESIGNED FOR HIGH
PRODUCTION INDUSTRIES!
Direct-Drive SUPER SERVICE Upright Drills, designed especially for high production industries, embody flexibility with single purpose simplicity, efficiency and durability. To show how this is accomplished without sacrificing adaptability and convenience, this booklet is presented. These simple, rugged, manufacturing type machines are a prime requisite of the automotive, electrical, home appliance, farm equipment, and other mass production industries. For more holes per dollar—Cincinnati Bickford Drilling Machines.
SINCE
SUPER SERVICE

IT HOLDS THE KEY TO MORE HOLES PER DOLLAR

Designed particularly for the mass production industries, this new line of Cincinnati Bickford Super Service, Direct Drive, Upright Drills, speedy, simple, rugged and reliable, will deliver more holes per dollar.

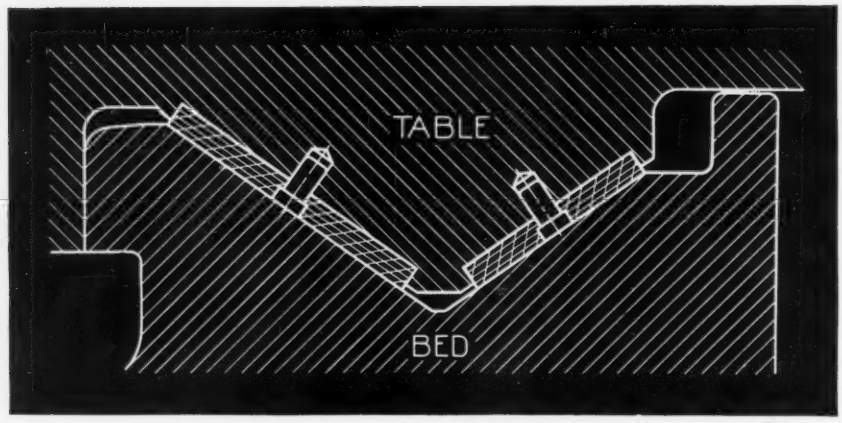
Your copy of Booklet U-27, heavily illustrated and with comprehensive data on capacities and construction, will be mailed on your request.

See our condensed catalog in Sweet's File.

Equal Efficiency of Every Unit Makes the Balanced Machine

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.



Construction Drawing Showing Method of Assembling Laminated Plastic Ways to a Planer Table

Gray Non-Metallic Ways for Machine Tables

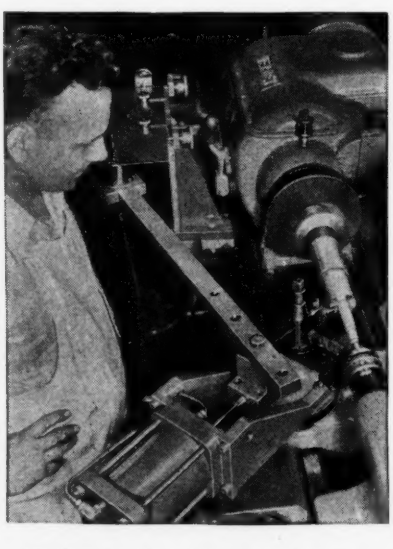
Non-metallic table ways consisting of laminated plastic plates which are secured to machine tables by means of laminated plastic pins have been developed by the G. A. Gray Co., Cincinnati, Ohio, as a means of maintaining the accuracy of machine tools. The manner in which the plastic plates are assembled to the table of a planer will be clear by referring to the illustration.

That these non-metallic ways have the non-scoring and wear-resisting qualities essential for guiding surfaces has been proved in the operation of a planer provided with the plastic plates, which has been in continuous service day and night for over two years. This planer was used for the heaviest type of work and operated at a normal return speed of 380 feet per minute. In spite of the severe service, there has been no evident wear on the table ways, according to Gray engineers. Because of the insulating quality of the laminated plastic plates, practically no heat is transmitted to the table proper. This makes it possible to operate planer tables at high speed without danger of the table curling up at the ends... 92

Bailey Duplicating Attachment

The simplified duplicating attachment for machine tools introduced by the Bailey Meter Co., 1050 Ivanhoe Road, Cleveland 10, Ohio, at the Cleveland A.S.T.E. Show employs a combined air and hydraulic system similar to that of the original Bailey contour control described in April, 1944, MACHINERY, page 212. The improved attachment can be readily applied to engine lathes, turret lathes, or vertical boring mills for use in automatically producing work with contours that correspond exactly with a thin metal templet or master part.

Simplification has been achieved by applying a single hydraulic-power cylinder to the lathe compound rest, which is usually set at an angle of 45 degrees to the longitudinal axis of the work. When mounted at this angle and used in conjunction with the standard longitudinal feed, the single power cylinder controls both the longitudinal and in-and-out transverse movements of the tool. Formerly it was necessary to apply power cylinders to both the longitudinal and cross feeds for full automatic operation. The attachment in no way hinders the normal use of a machine. The standard controls for speeds, feeds, and depth of cut function equally well with or without the attachment. 93



Bailey Duplicating Attachment Applied to Lathe

Eriez Permanent Magnet for Removing Iron Particles from Plastics

A non-electric Alnico permanent magnet designed to completely remove tramp iron and steel from plastic materials, through direct attachment to each individual machine, has been developed by the Eriez Mfg. Co., Erie, Pa. This magnet has been successfully applied in removing iron and steel particles from plastic materials used in injection, extrusion, and compression molding machines, thus eliminating much loss of production time, as well as damage to heaters, nozzles, and molds and the subsequent burning of the plastic in the scratches made in dies by foreign metals. This magnet, when applied to a molding machine, has the advantage of cleaning all the plastic, including new as well as reground material. 94

Carbide-Tool Grinder

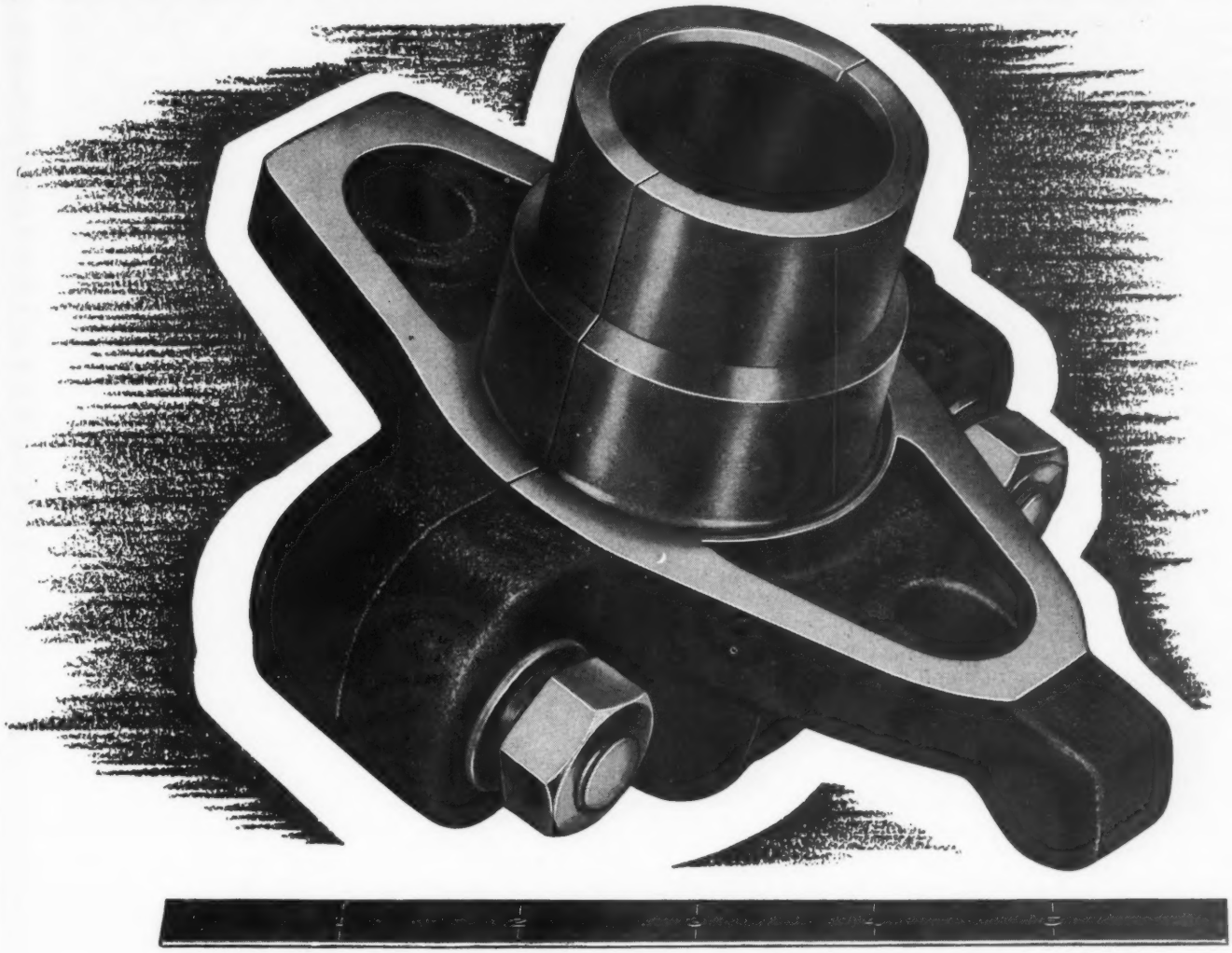
A Model 50-A grinder for rough, semi-finish, and finish grinding of carbide-tipped tools and other tool bits in sizes up to a maximum of 2 inches square or other shapes of equivalent cross-section area, has been added to the line of Willey's Carbide Tool Co., 1340 W. Vernor Highway, Detroit 1, Mich. A heavy-duty, ball-bearing, fully enclosed, 1/3-H.P., 3450-R.P.M. reversible type motor, with bearing take-up adjustment, is available as standard equipment on this grinder for operation on 60-cycle, three-phase, 220 to 240 volts.

The grinder has a drum type re-

Tool Grinder Built by the Willey's Carbide Tool Co.

To obtain additional information on equipment described on this page, see lower part of page 230.

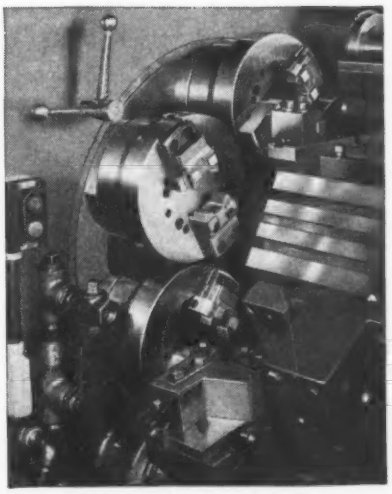
LEADERSHIP BASED ON ACCOMPLISHED FACTS...

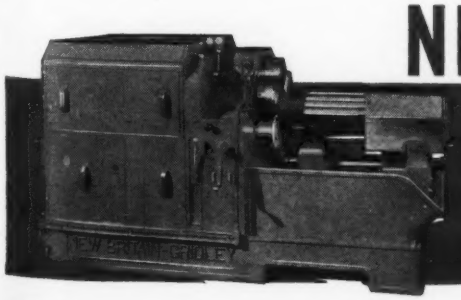


A case of machining a complete sub-assembly

Illustrated above is a malleable iron hub used in textile machinery. The two halves bolted together as shown are loaded exactly like a single piece, and our Model 16 Six Spindle Automatic Chucking Machine performs the facing, turning, chamfering and undercutting operations with a substantial saving of time and cost.

This interesting job may well suggest important possibilities in connection with your products . . . Our engineers will gladly put their time and experience at your disposal to help you discover profit-making advancement in any machining application. Consult the New Britain sales engineer in your locality or write The New Britain Machine Company.



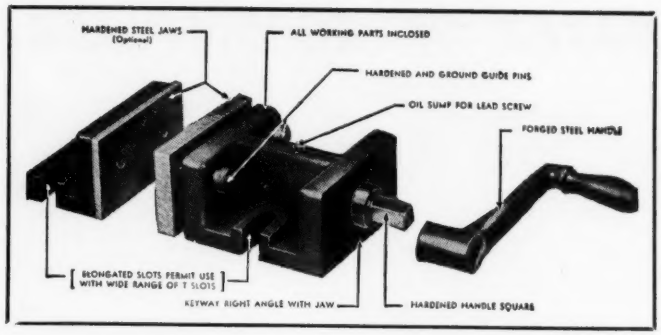


NEW BRITAIN AUTOMATICS

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT
NEW BRITAIN-GRIDLEY MACHINE DIVISION

M-01035

versing switch, coolant equipment with direct-drive pump and tank mounted inside the pedestal, and a semi-steel tool-rest table 6 by 12 inches. The table has graduations for setting to 15 degrees above and 30 degrees below the horizontal position. The machine requires a floor space of 19 by 30 inches, weighs 400 pounds, and is furnished with two 6-inch vitrified wheels, a protractor, and a diamond dresser. The specially designed adjustable splash guards enable coolant to be concentrated directly on the tool point. 95


HARDENED STEEL JAWS (Optional)
ALL WORKING PARTS INCLOSED
HARDENED AND GROUND GUIDE PINS
OIL SUMP FOR LEAD SCREW
FORGED STEEL HANDLE
ELONGATED SLOTS PERMIT USE WITH WIDE RANGE OF T SLOTS
KEYWAY RIGHT ANGLE WITH JAW
HARDENED HANDLE SQUARE

Porterfield "Milpal" Machine Vise

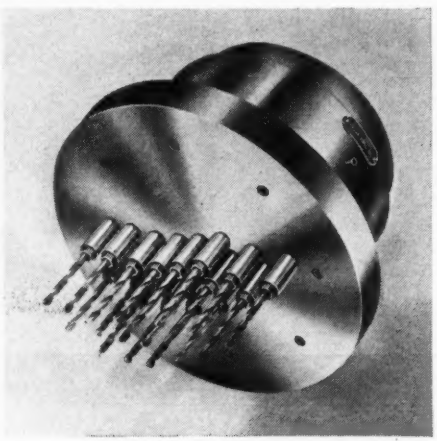
"Milpal" Machine Vise

A "Milpal" machine vise that can be adjusted to hold work of any length up to the maximum capacity of the table of any milling machine is being manufactured by the Porterfield Mfg. Co., 749 E. 15th St., Los Angeles 21, Calif. The new vise does not have the usual heavy base, but makes use of the flat table surface of the miller or other machine having a flat table with T-slots. This arrangement permits full working capacity of the machine from the table surface to the cutting tool to be utilized. It also enables the full length of the flat surface of the table to be used as a vise base. The vise jaws are operated manually by a steel lead-screw and bronze nut which run in oil. 98

Dumore Bench Drill

A light-weight high-speed bench drill for drilling holes up to 1/8 inch in diameter has been brought out by the Dumore Co., Racine, Wis., for use in the fabrication of small metal, wood, or plastic parts. The drill head is firmly held in the desired position on the polished solid steel column with a locking device which also holds the motor securely in place, yet permits vertical adjustments and a 360-degree radius of action. The table mounting is similar to that of the drill head.

Drilling is accomplished by elevating the table by means of a hand-wheel. Power is supplied by a 1/30-H.P. motor having a speed range of 2000 to 15,000 R.P.M., the speed being controlled by a foot-operated rheostat which permits free use of both hands for the drilling operation. The drill, which weighs only 15 pounds, can be used as a portable tool or it can be permanently mounted on a bench. 96



Zagar Gearless Drill Head with 9/32-inch Drills Spaced to 7/8-inch Center Distances

Cooper-Bessemer Turning and Cutting-Off Tool-Holders

Drop-forged lathe turning and cutting-off tool-holders that embody a patented feature for holding the cutting bits rigidly have been placed on the market by the Industrial Tool Division of the Cooper-Bessemer Corporation, Mount Vernon, Ohio. The patented holding feature consists of a clamping pin which engages the bit for almost its entire

Light-weight High-speed Precision Bench Drill Brought out by the Dumore Co.

Zagar Gearless Drill Heads

Gearless drill heads which can be applied to practically any multiple drilling or tapping job, due to the fact that an almost unlimited number of drills can be used and unusually close center distances are permissible, have been brought out by Zagar Tool, Inc., 23880 Lakeland Blvd., Cleveland, Ohio. As many as three hundred drills have been provided on one head. On stock sizes of these drill heads, 1/8-inch drills can be spaced to 1/4-inch center distances; 3/16-inch drills to 1/2-inch center distances; 3/8-inch drills to 3/4-inch center distances; 1/2-inch drills to 1-inch center distances; 5/8-inch drills to 1 1/4-inch center distances; 3/4-inch drills to 1 1/2-inch center distances; and 1-inch drills to 2-inch center distances.....97

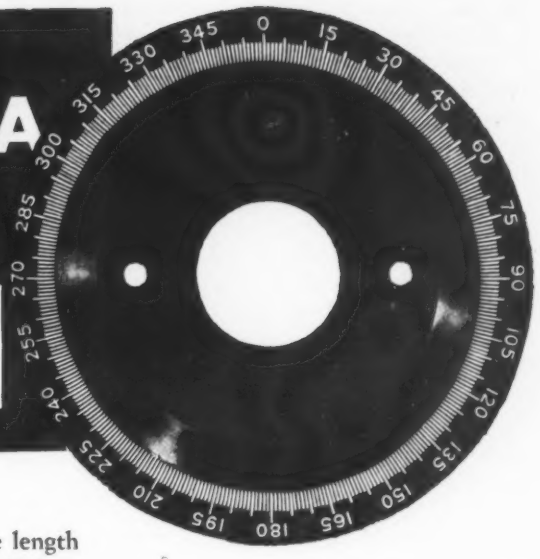
Turning and Cutting-off Tool-holders with a Patented Holding Fixture

To obtain additional information on equipment described on this page, see lower part of page 230.

MACHINING DATA ON PLASTICS

9. BRANDING

(PART TWO OF THREE PARTS)



This is the ninth in a series of messages designed to better your knowledge of the phenolics —the most versatile of all plastics... the type of plastics which Durez has specialized in producing for the past quarter century.

The branding method of marking a molded plastic part is a process which is a combination of burning and molding into the surface. A steel die under carefully controlled heat and pressure will produce clear, sharp, permanent markings to an average depth of .010".

Heat and Pressure Required

Molded phenolic plastics, being of a thermosetting nature and possessing a very hard surface, require much higher branding temperatures than thermoplastic materials, which can be branded at temperatures as low as 300° F. The average temperature range for the various types of phenolic materials is as follows: Rag-filled and laminated—600° F.; cotton- and wood-flour filled—650° F.; asbestos- and mica-filled—900° F. In some cases die conditions and other factors make it necessary to deviate slightly from the set temperatures.

The means of pressure consists of special machines, hand and automatic. For small quantities, a machine similar to an arbor press is used. The length of time that the pressure is applied on the molded part depends on the type of material being branded. This will vary considerably, depending on the fillers and resins used.

Where the marking is desired on the periphery of a cylindrical molded part, rotary machines are used. In these operations, the article to be branded is revolved against the face of the branding die.

Colors Permanently Fused

Contrasting, plain, and metallic colors permanently fused into the depressed markings are obtained from pigmented foils. These foils are approximately 200 feet long and are available in any desired width. The chemical formulae of the adhesives used on these foils must vary, depending on the type of filler and resin used in the molding material.

Owing to the inability of the foils to withstand the high branding temperature required for phenolic materials, it is necessary to produce the colors by means of a double pressing operation. The first pressing operation produces the required depth. This is followed by a *quick* second repeated cycle which presses the pigmented foil into the marking. In the event that the molded part is to be subjected to a continual contact with moisture which might injure the pigmented foil, the branded depressions should be filled with lacquer or varnish.

Economies of Branding

The marking of molded plastic parts by the branding process is quite prevalent in the plastics industry because of the economical simplicity with which blank stock parts can be produced in an inexpensive mold and then branded with any desired lettering.

Free Booklet

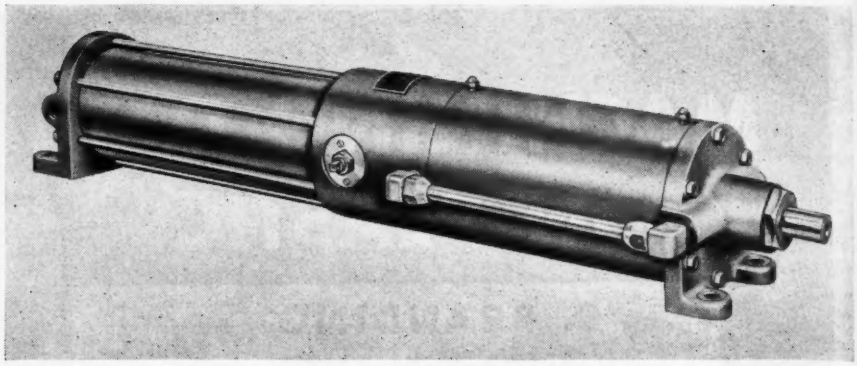
Write for free, authoritative booklet "Machining Data on Phenolic Plastics." You will find it most helpful because it covers all the standard phenolic plastic machining operations encountered in the average plant. No obligation, of course. Durez Plastics & Chemicals, Inc., 45 Walck Road, N. Tonawanda, N. Y.

The two molded phenolic parts shown have branded markings. Courtesy Rogan Brothers.

PLASTICS THAT FIT THE JOB

length. Two flush type set-screws lock the tool bit with a vise-like grip and prevent slippage. A dowel holds the clamping pin in position when inserting the bit, and prevents the pin from falling out when the bit is removed.

The tool bit is held rigidly in both vertical and horizontal planes, which is essential in using carbide-tipped bits. On the cut-off tool-holders, the blade is held vertical by a clamping pin on top, regardless of any side pressure imposed on the blade.....99

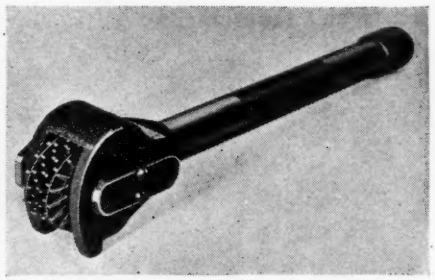


"Air-Draulic" Cylinders with Separate Air- and Hydraulically-operated Pistons Assembled on One Piston-rod

Logan "Air-Draulic" Cylinders

"Air-Draulic" cylinders which are built with separate air- and hydraulically-operated pistons that are assembled as an integral unit on a common piston-rod are a recent development of the Logansport Machine Co., Inc., 910 Center Ave., Logansport, Ind. In these units, the rod movements are actuated by the air cylinder, which may be controlled by a four-way valve. As the piston-rod with its two pistons is moved, oil flows between the chambers of the hydraulic cylinder, these chambers being connected externally by a self-contained circuit. An adjustable built-in speed control valve in the circuit regulates the flow of oil and, therefore, the speed of the piston-rod movement. No separate hydraulic power unit is required.

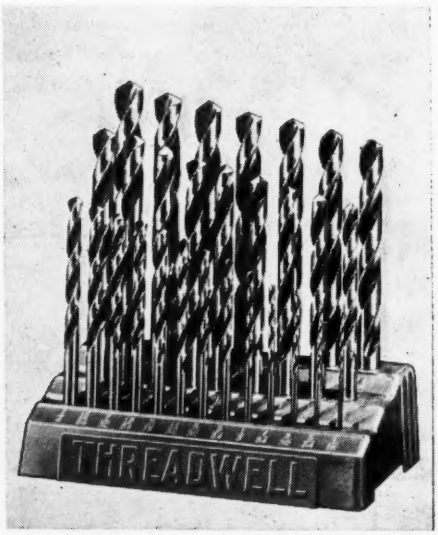
The "Air-Draulic" cylinders can be furnished for a controlled feed with rapid return in either direction or for a controlled feed in both directions. Skip feed movements can be provided through cam valves in the hydraulic circuit. The cylinders are available in four standard sizes, with a bore of 3 to 8 inches and any length of stroke up to 5 feet.....100



Samson Grinding-wheel Dresser with Forced-feed Lubrication

Samson Grinding-Wheel Dresser

A grinding-wheel dresser provided with a system of forced-feed lubrication has been brought out by the G. J. Wallen Mfg. Co., 617 Bryant St., San Francisco 7, Calif. One of the advantages claimed for this design is that it obviates the possibility of grit being fed back into the dresser, so that there is no chance of the bearings or the shaft hole in the cutting star being damaged before the dresser teeth are worn out. This tool is available in two sizes, a No. 1 for grinding wheels up to 12 inches in diameter by 2 inches face width, and a No. 2, which is applicable for dressing wheels of unlimited size. 101



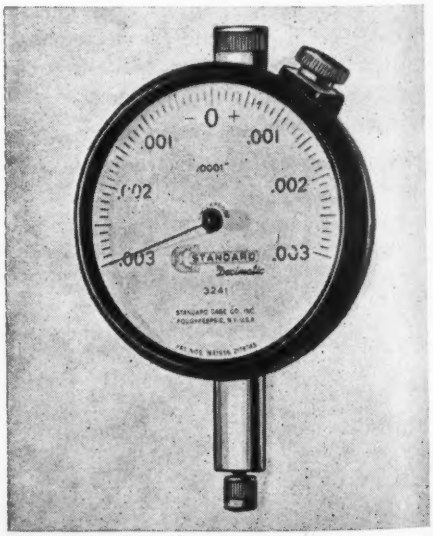
Twist Drills Made by the Threadwell Tap & Die Co.

Threadwell High-Speed Twist Drills

The Threadwell Tap & Die Co., Greenfield, Mass., has added to its line of high-speed taps and other tools a complete line of high-speed twist drills. The new line includes taper-shank drills in all standard sizes up to 1 1/2 inches diameter, and straight-shank drills in various taper lengths, in wire-gage sizes from No. 1 to 60, and in jobbers' lengths with diameters ranging from 1/16 to 1/2 inch, in increments of 1/64 inch. The straight-shank drills are supplied in metal stands, with each size of drill marked on the stands. Sets are also available in cadmium-plated steel containers...102

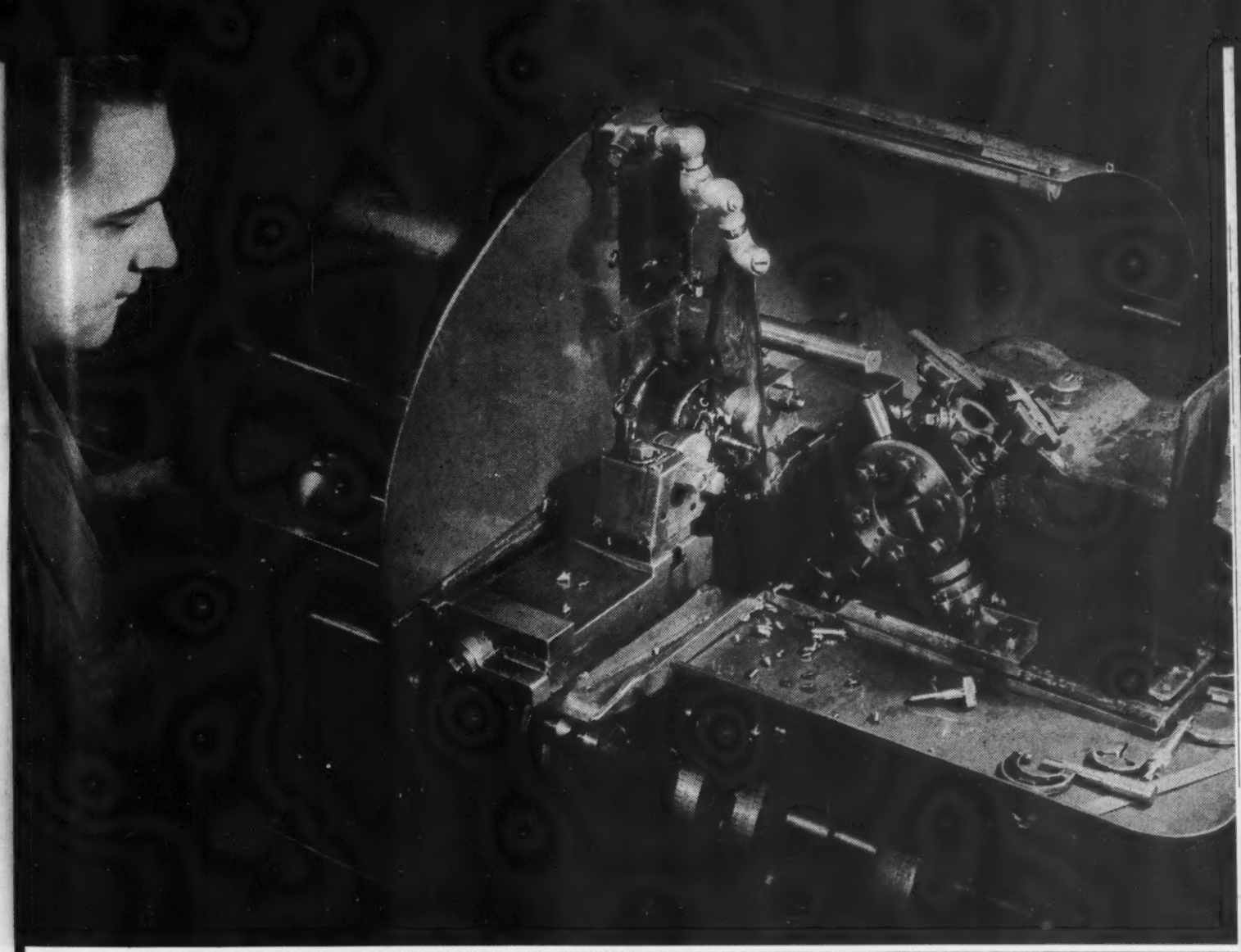
"Decimatic" Indicators for Checking Close Tolerances

A "Decimatic" series of indicators designed for close-tolerance checking has been introduced to the trade by the Standard Gage Co., Inc., Poughkeepsie, N. Y. These indicators have dial markings in decimals which are directly comparable to blueprint tolerances. Working advantages include the restriction of the indicator hand



"Decimatic" Indicator, which is Graduated in Decimals

To obtain additional information on equipment described on this page, see lower part of page 230.



STAINLESS STEEL . . . TOOL LIFE *Up 400%*

SUNICUT . . .

Increases Production from 75 to 380 Pieces per Grind

A manufacturer of automotive parts formerly obtained from 20 to 75 pieces between tool grinds, and was troubled with high drill-breakage.

Changing to Sunicut, for a cutting lubricant, he was able to increase tool life more than four hundred per cent — to 380 pieces per grind. Finish was improved. Here are the facts:

Machine . . . Brown & Sharpe 2-G Automatic	**Operations . . . Drilling, reaming, forming, and cutting off**
Material . . . Stainless steel	**Cutting Lubricant . . . Sunicut**

For heavy cuts at high speeds, for high accuracy, and satin smooth finish, Sunicut is widely used for many different types of cutting operation.

Sunicut is a clear, free-flowing, sulphurized oil produced by an exclusive Sun process. It has high lubricating qualities, is an excellent dispenser of heat. Call the Sun Cutting Oil Engineer near you for full details.

SUN OIL COMPANY • *Philadelphia 3, Pa.*

Sponsors of the Sunoco News-Voice of the Air — Lowell Thomas

SUN

SUNOCO

INDUSTRIAL PRODUCTS

WHICH SIDE OF THIS LINE

Are You On?

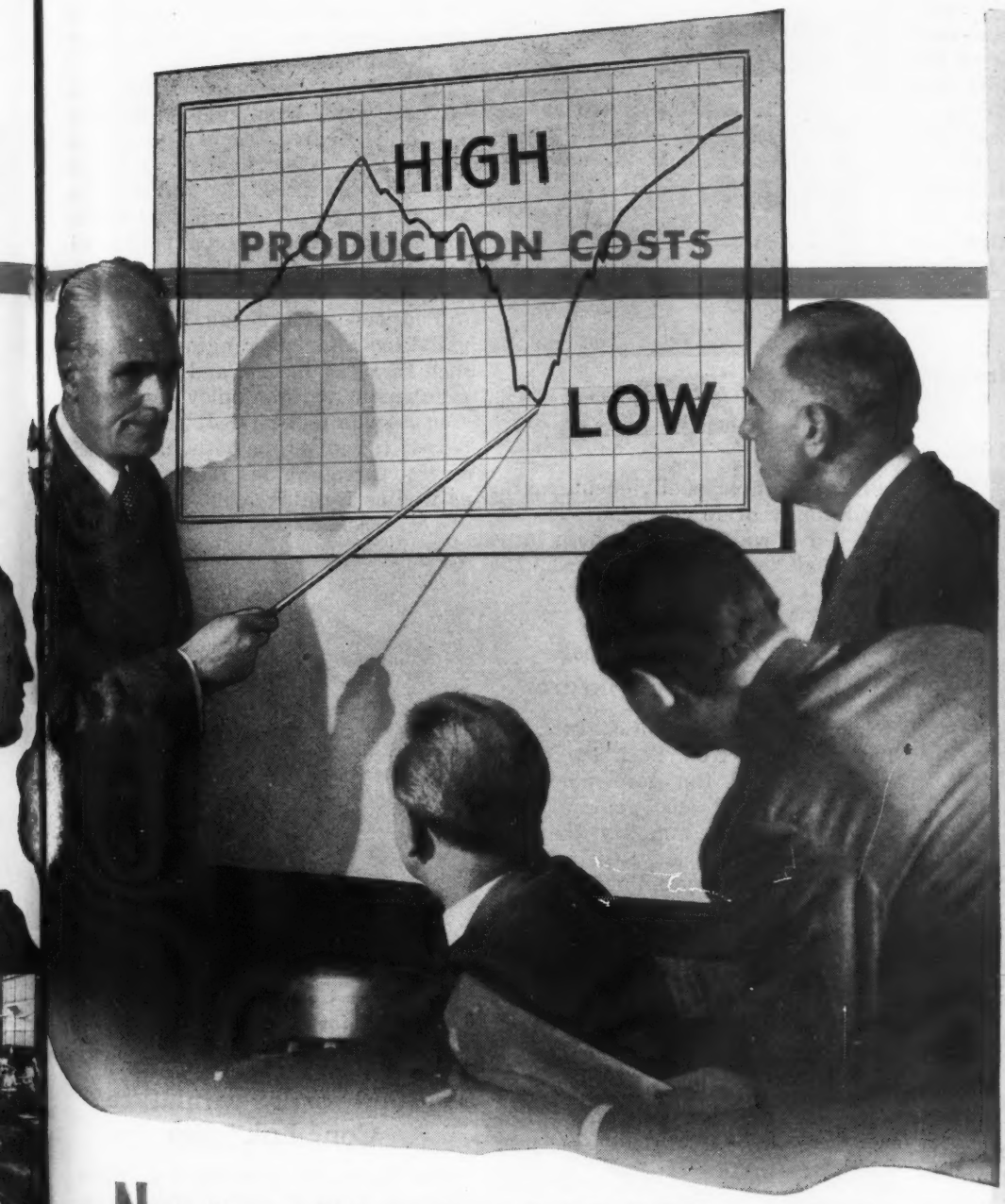
EX-CELL-O's Complete Parts Production Facilities Can Help You Lower Unit Costs

XLO

EX-CELL-O *for* PRECISION

Shown are two typical views of Ex-Cell-O's parts manufacturing facilities. *Left:* Multiple spindle automatic screw machines roughing miscellaneous parts from tubing and bar stock. *Above:* One of the many production lines where sequence of operations is efficiently engineered for low cost production.

EX-CELL-O CORPORATION



Not all manufacturers know that Ex-Cell-O can offer the highest quality production of parts and assemblies at a remarkably low cost per unit. This is because of Ex-Cell-O's unique combination of engineering experience, skilled manpower, and the most modern facilities, including machining, heat-treating, grinding, sub-assembling, and inspection—all under one management. Send your print or part to Ex-Cell-O at Detroit today, or contact one of Ex-Cell-O's field engineers in leading industrial centers throughout United States and Canada.

DETROIT 6, MICH.

EX-CELL-O's Precision Production Parts *facilities:*

PRODUCTION ENGINEERING

The Ex-Cell-O organization, with skill, facilities and modern methods that have made a wartime record, can make an important contribution in the planning of quantity production of quality parts and unit assemblies for your postwar product.

PRODUCTION MACHINES

Multiple Vertical Turret Lathes
Multiple Spindle Automatic Screw Machines
Single Spindle Automatic Screw Machines
Hand Screw Machines
Engine Lathes
Centerless O.D. Grinders
Centerless I.D. Grinders
Single and Multiple Spindle Drilling Equipment
Form Grinding Machines
Plain O.D. Grinders
Plain I.D. Grinders
Surface Grinders (Plain and Rotary)
Milling Machines
Thread Milling Machines
Broaching Machines (Vertical and Horizontal)
Precision Thread Grinders
Thread Rolling Machines
Precision Boring Machines
Lapping Machines
Special High Production Equipment

HEAT TREAT

Induction Heat Treating
Laboratory for Heat Treat Control including Micro Examination and Photography
Atmosphere Control Continuous Hardening Furnaces
Atmosphere Control Box Hardening Furnaces
Various Types of Air-Draw Batch Type Furnaces
Gas Carburize Furnaces
Box Carburize Furnaces
Pack Anneal Furnaces
Nitriding Furnaces
Cyanide, Lead, and Neutral Salt Pot Furnaces
High Speed Steel Atmosphere Control
Vertical and Horizontal Hardening Furnaces
Continuous Air-Draw Furnaces
Sub-Zero Heat Treating Equipment

UNIT ASSEMBLIES

For many years Ex-Cell-O has supplied large and small manufacturers with parts and has also supplied many parts in unit assemblies after machining, heat treating and grinding.

INSPECTION

Ex-Cell-O has always maintained that quality in a product is not the result of accident; that quality is built into a product by rigid adherence to accepted quality standards . . . standards that are upheld at Ex-Cell-O by efficient inspection at every step of the machining process.

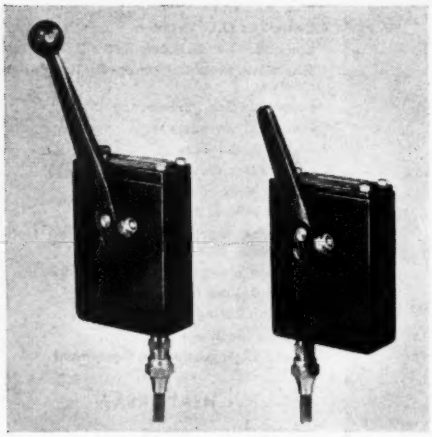
Where increased production, high accuracy, and greater economy through multiple operations are required . . . See Ex-Cell-O First!

46—42

movement to approximately one-third revolution to the left and one-third revolution to the right of the zero point. This range, while adequate for all but coarse tolerance checking, eliminates the possibility of failure on the part of the inspector to notice a complete revolution of the dial hand. Nineteen different models of these indicators are available, graduated in both English and metric units. 103

Sperry Miniature Hydraulic Control

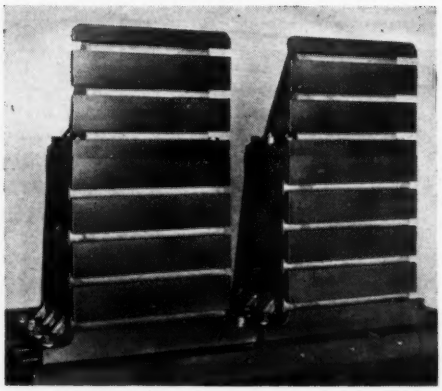
Sperry Products, Inc., 1505 Willow Ave., Hoboken, N. J., has developed a miniature hydraulic remote control having all the advantages of the larger units made by this company. The transmitter and receiver units are made of bronze, and together weigh only 3.7 pounds. Any motion of the transmitter arm is duplicated by the receiver arm, which can be operated through an arc of 60 degrees. The two units are dustproof and waterproof. They can be separated by as much as 35 feet and joined by copper tubing. 104



Miniature Hydraulic Remote Control Units Made by Sperry Products, Inc.

Combination Matched Angle-Blocks

Matched angle-blocks for accurately locating and chucking work when performing boring, milling, and planing operations, and for toolroom and other general-purpose uses, have been announced by the DeVlieg Machine Co., 450 Fair Ave., Ferndale 20, Detroit, Mich. These matched units, machined from box-section castings with T-slots and flat surfaces in precise alignment, can be used singly or in combinations suitable for a wide range of both large and small work. 105



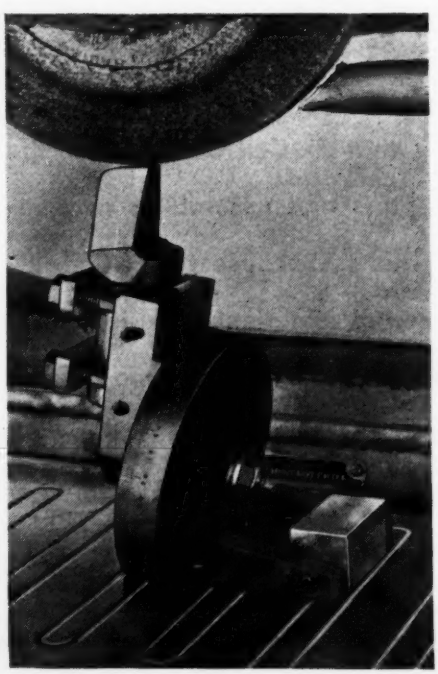
DeVlieg Combination Matched Angle-blocks

Scherr All-Purpose Tool-Grinding Fixture

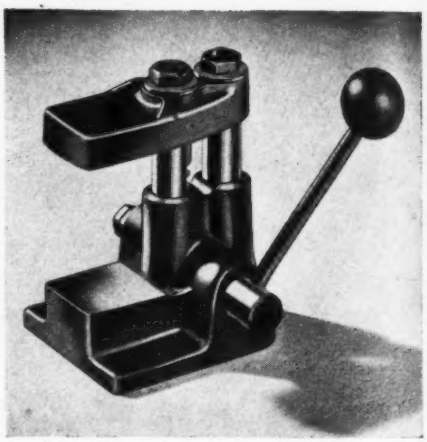
The George Scherr Co., Inc., 199 Lafayette St., New York 12, N. Y., has announced the development of an "all-purpose" tool-grinding fixture designed to simplify the precision-grinding of lathe tools, screw machine form tools, and shaper, planer, milling machine, or any type of angle cutting tool. The fixture operates on a new patented principle involving compound angles. It is placed on the magnetic chuck of a surface grinder, and is firmly held by the magnetic force of the chuck, thus eliminating some of the uncertainties of hand-grinding.

This fixture is graduated for both left- and right-hand angular settings up to 90 degrees each side of the zero point. In addition, it can be set for grinding the rake angle on a tool by means of a tipping or indexing block, which can be positioned to give rake angle clearances of 3, 5, 7, and 10 degrees.

The new fixture can be used to grind tools in sizes ranging from 1/8 inch to 1 1/4 inches, and is adapted for grinding carbon, alloy, and tungsten-carbide tool bits. It can be employed for grinding both inside and outside threading and recessing tools, as well as forming tools. 106



All-purpose Tool-grinding Fixture Announced by George Scherr Co.



"Miniature Cone-Lok" Jig Designed for Small Parts

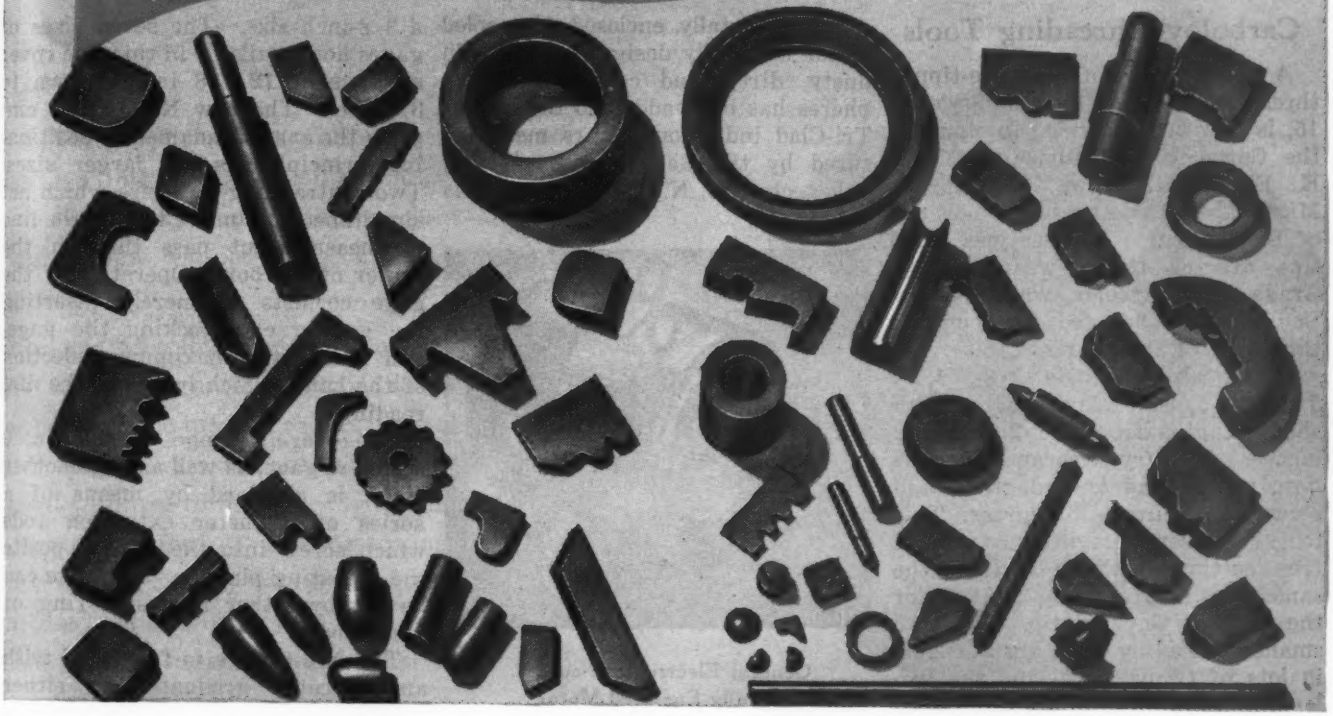
Woodworth "Miniature Cone-Lok" Jigs

The N. A. Woodworth Co., Sales Division, 1300 E. Nine Mile Road, Detroit 20, Mich., has brought out two new "Miniature Cone-Lok" jigs of versatile design for use in tooling up for the machining of very small parts. These clamping type jigs have a minimum number of moving members, and although small in size, are of rugged construction. They can be assembled or dismantled quickly, and can be converted from right- to left-hand operation in two minutes' time. The moving members operate in a bath of oil.

No movement of working parts is possible without actuation of the operating lever. The tray is positively clamped by instant action of the "Cone-Lok" in the event of suddenly applied weight or pressure. These jigs are available for working spaces of 1 by 1 by 1 inch, and 1 inch by 2 inches by 1 inch. 107

To obtain additional information on equipment described on this page, see lower part of page 230.

Any Shape or Size CARBOLOY (TRADEMARK) CEMENTED CARBIDE Blank to Fill Your Special Needs



By any measure, the best in special shape blanks is Carboloy Cemented Carbide! This "hardest metal made by man" is ideal for tips or inserts on tools, gages, cams, guides, work rests—any part or product subject to abrasive wear.

Made to your exact specifications, Carboloy Special Blanks are supplied ready for brazing into place, and grinding to final dimensions is simply a matter of stock removal measured in thousandths—then the part is ready for use.

Modern, Carboloy-engineered forming methods make fabrication, to practically any size or shape, a fast—accurate—economical operation, and the savings are passed on to you. Send for free catalog GT-175R.

Specially Shaped **CARBOLOY** (TRADEMARK) CEMENTED CARBIDE Blanks

CARBOLOY COMPANY, INC. • 11147 E. 8 Mile Blvd. • Detroit 32, Michigan

CHICAGO • CLEVELAND • HOUSTON • LOS ANGELES • MILWAUKEE • NEWARK • PHILADELPHIA • PITTSBURGH • THOMASTON

Also Sold by Leading Mill Supply Distributors

Carbide-tipped Threading Tools Made by Carboloy Company

Carboloy Threading Tools

A new line of carbide-tipped threading tools, designated Style T-15, is now being carried in stock by the Carboloy Company, Inc., 11147 E. Eight Mile Blvd., Detroit 32, Mich. These new threading tools are of the 60-degree V-nose type. The tips are of tough wear-resistant Grade 78-B Carboloy, which is particularly well adapted for long-run threading of steel parts.

Shank sizes include 3/8-, 1/2-, 5/8-, and 3/4-inch square styles with shank lengths from 2 1/2 to 4 1/2 inches. Primary clearance at the nose of the tool is 3 degrees, and secondary clearance 6 degrees. This tool has been designed to provide free cutting qualities and at the same time insure ample support for the nose of the tool tip. The two smaller threading tools are available in lots of twelve each, and the two larger sizes in lots of six each.....108

Dake Punch Press Guard

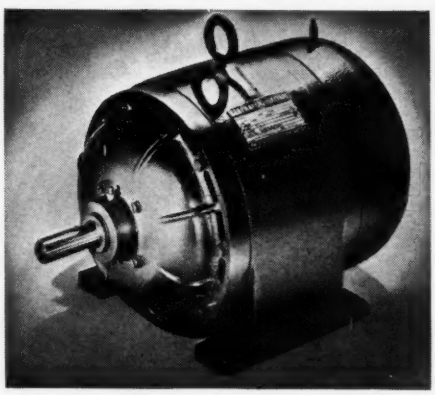
A new punch press guard designed to protect the operator against accidents on all types of hand-fed punch presses has been announced by the Dake Engine Co., Grand Haven, Mich. This guard can be applied to almost any type of ram-action machine, such as punch presses, brakes, and spot-welders.

Guard for Hand-fed Punch Presses

The guard protects the operator during all hand-feeding operations. It is entirely mechanical, positive in action, and operates even when failure of the press might otherwise cause a serious accident. 109

General Electric Enclosed Fan-Cooled Motor

A new totally enclosed fan-cooled motor especially designed for use in dusty, dirty, and corrosive atmospheres has been added to the line of Tri-Clad induction motors manufactured by the General Electric Co., Schenectady 5, N. Y. This motor is



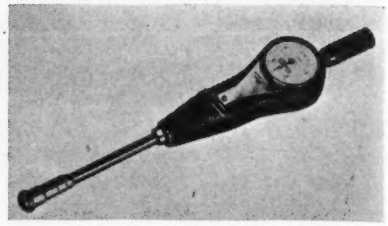
General Electric Fan-cooled, Totally Enclosed Motor

available in standard sizes of from 1 to 1000 H.P., and can be employed where iron dust and metal filings are in the air, as well as in various hazardous locations. Being of compact construction, the motor can be installed in a small space, which makes it especially suitable for machine tool applications in which the motor must be part of the driven machine.

The new features include a double-shell cast-iron frame and cast-iron end shields and conduit box which provide protection from external blows, dripping water, dust, vapors, and corrosive liquids. Punchings and windings within the inner shell of the motor are cooled by a non-sparking external fan protected by a housing. 110

Small Dial Type Bore Gage

The Standard Gage Co., Inc., Poughkeepsie, N. Y., is extending the range of its line of dial type bore gage instruments by the addition of a 3/8-inch size. The seven sizes of gages now available in this line cover a range of 12 1/8 inches down to 3/8 inch. The new No. 0 gage employs the same fundamental positioning principles as the larger sizes. Two centralizing plungers which act simultaneously insure having the line of measurement pass through the center of the bore. Operation of the gage consists of merely inserting the gaging end, rocking the gage, and noting the maximum deflection of the hand, which indicates the dial reading.



Dial Type Bore Gage Made by Standard Gage Co.

The over-all range of the No. 0 dial bore gage, as well as of the other sizes, is obtained by means of a series of diameter extension rods which screw into the head opposite the actuating plunger. The gage can be set by either a master ring or gage-blocks.

The No. 0 gage is furnished with an indicator graduated in either 0.0001 inch or 0.002 millimeters. Although the indicator is of small size, the dial diameter being scarcely over an inch, it is claimed that it will give accurate readings within 0.00002 inch. Diamond points can be supplied, and are recommended for this gage when it is to be used for long-run inspection work. 111

Water-Soluble "Microgrind" Fluid

A new water-soluble grinding fluid has been brought out by the Quaker Chemical Products Corporation, Conshohocken, Pa., for use with the Quaker "Microgrind" process. This new fluid, known as "Quaker Microgrind 70," is said to give excellent results in performing abrasive operations on all types of steel and most other metals.

It is claimed that this fluid will not become rancid nor develop disagreeable odors even when mixed with extremely hard water or when used for grinding cast iron, and that it can be used for three months or

To obtain additional information on equipment described on this page, see lower part of page 230.

What's all this about SUPERFINISH?

• If you've thought of *Superfinish* as a lavishment, then perhaps it's time to look into it a little further. You'll find enough evidence to change your notions—and perhaps give you a new competitive advantage in the form of lower costs.

No matter how fine a ground surface may appear to the eye, it has defects . . . scratches and ridges produced by the point of the turning tool . . . larger defects such as grinder feed spirals and chatter marks . . . partially loosened splinters of metal ready to come off on contact with another surface . . . soft surface metal, annealed by the heat of the grinding wheel. In practically every case, fragmented metal will be torn from the mating surfaces to mix with lubricants, causing abrasive wear and creating a larger amount of clearance.

Superfinishing prevents this by removing both grit scratches and longer pitch defects due to minute machine tool inaccuracies. It provides the surface smoothness to maintain a uniform oil film—to reduce wear—to eliminate bearing trouble and lengthen bearing life.

Superfinishing is a quick and inexpensive process. And in many cases it can reduce present manufacturing costs by eliminating other more costly processes. This is a good time to get complete information about *Superfinishing*. Write us.

GISHOLT MACHINE COMPANY
1209 *East Washington Avenue* • *Madison 3, Wisconsin*

GISHOLT

Look ahead

keep ahead

with Gisholt

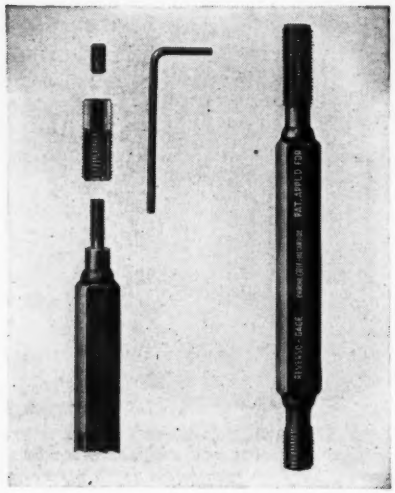
This photomicrograph (25 x magnification) shows a ground surface with the familiar scratches and ridges caused by single direction stock removal. Surface roughness is 35 micro-inches (Profilometer reading).

The same piece, 30% Superfinished to 15 micro-inches. Note how ridges have been reduced. A completely Superfinished surface of 2 to 3 micro-inches will leave no defects to penetrate the oil film or abrade the mating surfaces.

longer without change if make-up fluid is added periodically. It is also claimed that this fluid does not accumulate on the machines. 112

"Reverso" Thread Plug Gage

A new chromium-carbide thread plug gage is being manufactured by the George O. Griffin Co., 1301 W. Hadley St., Whittier, Calif., which has a gaging element that can be reversed in the shank of the holder and securely locked in place when the end has become worn below the normal limits. The new gage end thus made available restores the gage to its original accuracy and serves to practically double its useful life. The use of chromium-carbide for the gaging plugs also serves to increase the life of the gages many times. These "Reverso" gages are available in sizes of 1/4 inch to 1 1/2 inches outside diameter. 113

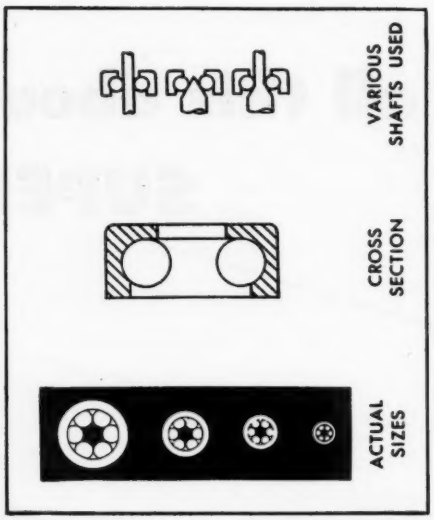


Thread Plug Gage with a Reversible End

Miniature Angular-Contact Ball Bearings

A versatile midget-size ball bearing of a new angular-contact design has been added to the line of Miniature Precision Bearings, Keene, N. H. This bearing is now being used in electric motors, scale mechanisms, and accelerometers. It will take radial and thrust loads, or a combination of both, and will function safely under unusually heavy loads and high speeds for its weight and size.

The bearing is made in four sizes, with outside diameters ranging from 0.1250 to 0.3750 inch, and for shaft diameters from 0.032 to 0.094 inch. No separator or cap is required with these bearings, since the balls are fully self-contained. These new bearings are made of chrome-alloy steel to precision tolerances. 114

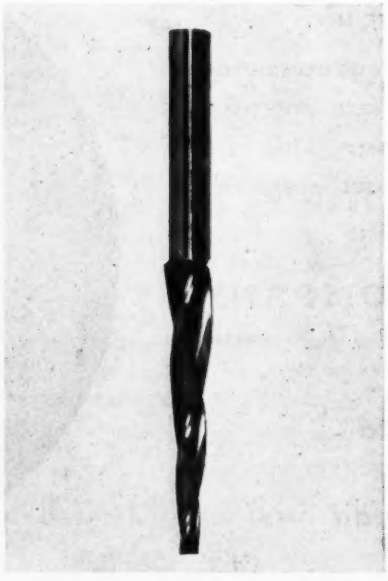


Midget-size Ball Bearings Made by Miniature Precision Bearings

Tapered Cutting Tool of End-Mill Type

A tapered cutting tool or end-mill especially adapted for use in making die-casting dies, plastic molds, rubber molds, and wood or metal patterns, and for machining any work requiring draft or relief, has been added to the line of the Conical Tool Co., 423 Division, S., Grand Rapids 3, Mich. This tapered end-mill is made with a constant spiral, with a uniform angle for the entire length of the flute, and will cut as well at the bottom as at the top end. The three flutes with which the tool is provided are said to have the cutting quality of a two-blade end-mill and to produce a finish equal to that obtained with a four-blade tool.

These hollow-ground tools are made in a range of diameters from 1/8 to 1/2 inch at the small end in 1- and 2-degree styles, and from 1/8 to 3/8 inch at the small end in 3-, 5-, and 7-degree styles. 115



Tapered End-mill Made by the Conical Tool Co.

Aireon Optical Micrometer

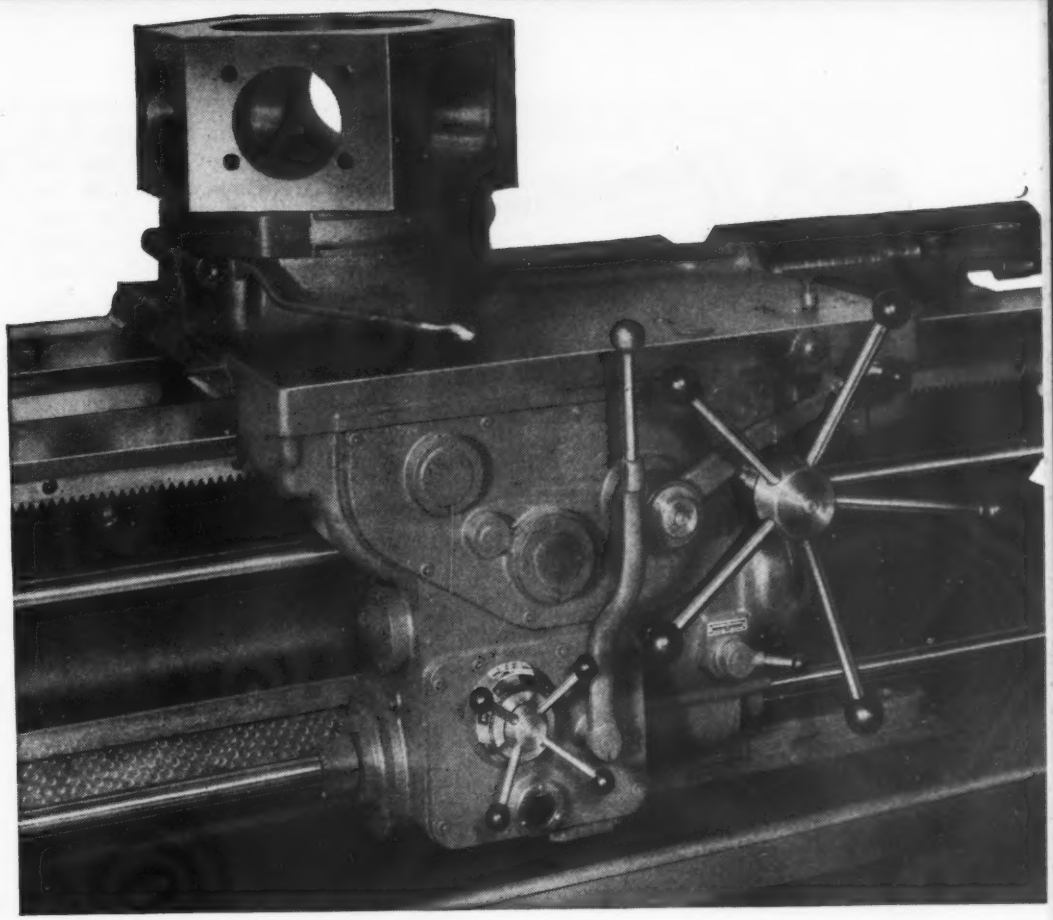
Mechanical micrometers can be used to measure the thickness of small flat pieces of Lucite, Plexiglas, or plate glass without difficulty, but when the sheets are large, it is necessary to provide other means for determining the thickness in the central positions or in positions that are inaccessible to the ordinary micrometer. The measurement of curved plastic sheets is also difficult, since the ball head of the mechanical micrometer tends to sink into the plastic. To overcome these difficulties, an optical micrometer has been developed by the Aireon Mfg. Corporation, 166 W. Olive Ave., Burbank, Calif.

Optical Micrometer Developed by Aireon Mfg. Corporation

The transparent sheet is marked with a crayon on the under side, away from the instrument, and a measurement is obtained by sharply focussing the mark in the microscope. Reading on the barrel and thimble gives the thickness of the sheet directly. 116

To obtain additional information on equipment described on this page, see lower part of page 230.

LONG SADDLE



—WIDE STRADDLE!

for

fast, heavy, accurate cuts!

Here's one of the reasons why Gisholt heavy duty turret lathes make smooth work of the toughest cuts. It's the design of the Gisholt saddle that provides a firm turret seat—that assures firmly held, chatter-free tools.

It starts with ample length of the saddle and a wide straddle over the ways to assure maximum rigidity and freedom from vibration. With ample bearing surface on block type ways, rigidity is further enhanced by square lock construction and adjustable gibs. Moreover, this accuracy is permanent because Gisholt's ways are of hardened steel, providing a surface that is virtually wear-proof on all sides.

It all adds up to dependable accuracy down through the years—a better investment in high production turret lathe equipment. Ask for literature.

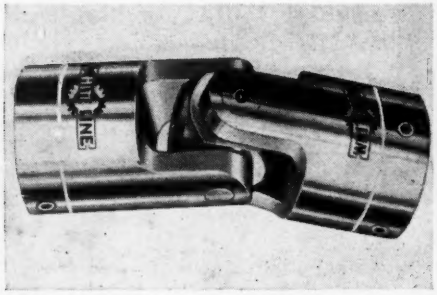
Extreme rigidity is required where tools must take heavy cuts, like the Gisholt 4L shown above, simultaneously facing with the square turret and boring with the hexagon turret.

GISHOLT MACHINE COMPANY
1209 E. Washington Avenue • Madison 3, Wisconsin

Look Ahead . . . Keep Ahead . . . with
Gisholt Improvements in Metal Turning

GISHOLT

TURRET LATHES · AUTOMATIC LATHES · SUPERFINISHERS · BALANCERS · SPECIAL MACHINES



"White Line" Universal Joint Made by American Gear & Mfg. Co.

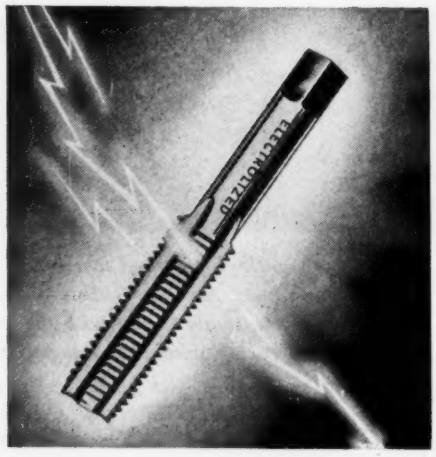
"White Line" Precision-Made Universal Joints

The "White Line" universal joints recently placed on the market by the American Gear & Mfg. Co., 6633 W. 65th St., Chicago 38, Ill., have been developed to provide smooth, efficient transmission of power. Dependable performance, accuracy with respect to concentricity, maximum operating angles, and maximum strength with minimum weight are features claimed.

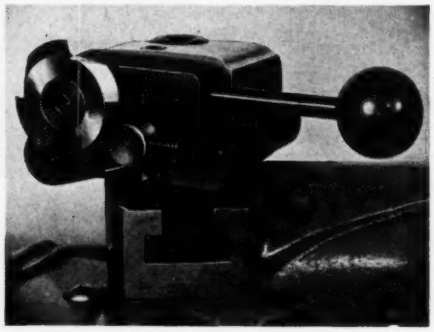
These universal joints are available in nineteen standard stock sizes, the smallest having a maximum rating of 0.2 H.P., a maximum speed of 2200 R.P.M. at an angle of 10 degrees, and a weight of approximately 0.04 pound, and the largest a maximum rating of 80 H.P., a maximum speed of 250 R.P.M. at an angle of 10 degrees, and a weight of approximately 20.60 pounds. 117

"Electrolized" Taps

The Electrolized Tap Corporation, 148 W. River St., Providence 1, R. I., is placing on the market a complete line of high-speed taps treated by what is known as the "Electrolizing" process. This process combines the application of high voltage with a chemical bath and a rare metal to produce an exceedingly hard case on the cutting edges, as well as on the entire surface, of the tap. The thin deposit or case shows a Rockwell hardness of approximately 83 C without brittleness. The deposited alloy also reduces chip and surface friction. The accuracy of the tap is not affected by the "Electrolizing" process, as the process adds only 0.00003 inch of metal over the surface of the tool. Standard and spiral-pointed hand and machine screw "Electrolized" taps are available for tests under operating conditions. 118



"Electrolized" Tap



Foulk Retract-A-Tool Equipped with Formed Threading Tool

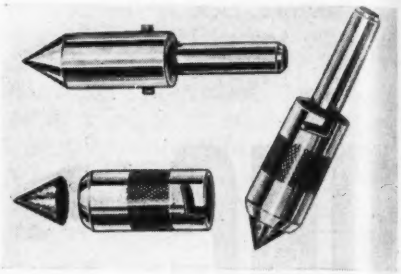
Foulk Retract-A-Tool for Thread Cutting

The Foulk Engineering Co., 4208 Airport Road, Cincinnati 26, Ohio, has brought out a formed threading tool for chasing external threads, which is a modification of the retractor tool equipment previously introduced by this company. The illustration shows the new formed threading tool mounted on a No. 1 size Retract-A-Tool holder. This threading tool has four cutting edges, is replaceable, and can be obtained in five standard sizes with the proper flat on all edges for 32-18, 16-11, 10-9, and 8 threads per inch or with one edge arranged for each thread range.

The threading tool designed for use on the No. 1 size Retract-A-Tool is 1 5/8 inches in diameter, while the one designed for the No. 2 size Retract-A-Tool is 2 1/8 inches in diameter. The Retract-A-Tool holder is so designed that it instantly snaps the tool away from the work at the end of each threading cut at precisely the same point. This permits increased spindle speeds to be used without danger of the tool digging into the work at the end of the thread. 119

Reich Center-Lapping Tool

The J. R. Reich Mfg. Co., 45 E. Stroop Road, Dayton, Ohio, has recently placed on the market a new



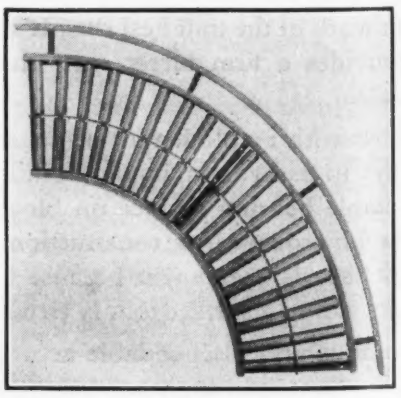
Reich Center-lapping Tool with Replaceable Emery Cloth Cone

center-lapping tool in which easily replaceable emery cloth cones are used which fit over an accurately machined and ground 60-degree mandrel. The cones are formed with a curved seam which assures accurate lapping and no chatter.

These cones are available in 100, 120, and 150 grit grades. They are held securely in place on the mandrel by a sleeve with a quick-acting bayonet lock, which makes the changing of cones a matter of seconds. 120

"Packaged" Line of Roller Conveyors

Lyon Metal Products, Inc., Clark St., Aurora, Ill., is marketing a completely "packaged" line of gravity

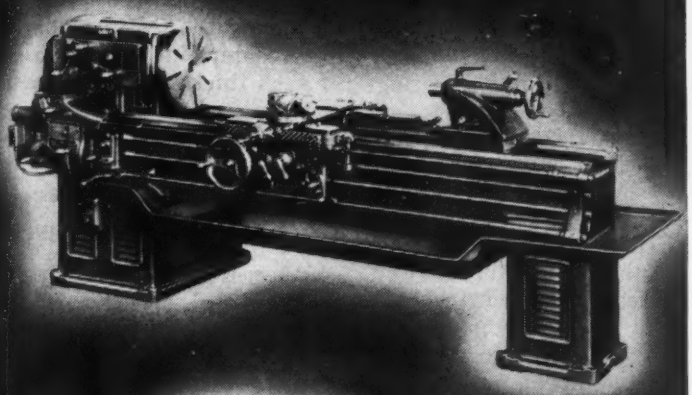


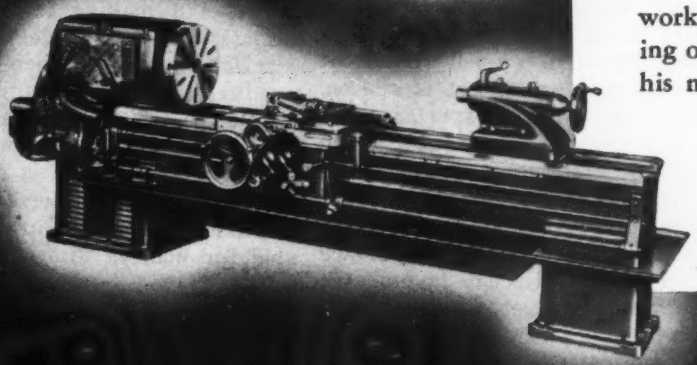
Roller Conveyor Unit Placed on the Market by Lyon Metal Products, Inc.

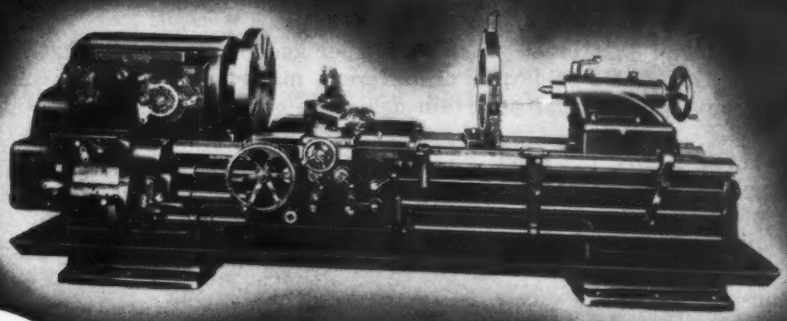
roller conveyor units for handling and transporting cartons, bales, boxes, crates, and many other types of articles and merchandise in a wide range of dimensions. They are

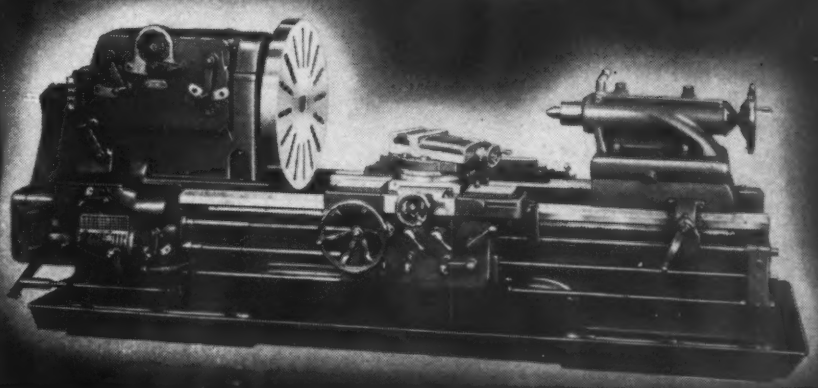
To obtain additional information on equipment described on this page, see lower part of page 230.

Sidney Lathes









Illustrating the wide range of Sidney Lathes . . . built in capacities from 14" to 36"

All are continuous tooth Herringbone geared head machines. The Headstock is particularly quiet in operation with both spindle and intermediate shaft supported by a center bearing.

This gearing not only affords greater, smoother power on all sizes but results in highly finished accurate work free from all tooth marks.

The departure from the conventional two wall bed to the Sidney four wall design with cross girts at frequent intervals assures the utmost in rigidity and maintaining alignment.

The operator is saved considerable leg work, and a great deal time by locating of controls within easy reach from his normal working position.

For power, speed and continued accuracy make your next lathe a Sidney.

Bulletins available.

Builders of Precision Machinery

THE SIDNEY MACHINE TOOL COMPANY

SIDNEY • OHIO

SIDNEY

ESTABLISHED 1904

now available in the following sizes: Three straight sections, all 10 feet long, in widths of 12, 18, and 24 inches; three 90-degree curved sections in 12-, 18- and 24-inch widths; and two trestles 18 and 24 inches wide. 121

Standardized Cylinders

A standardized cylinder for operation by air, oil, or water, which lends itself to almost universal mounting applications, is being manufactured in quantities by the Engineering Products Co., 1600 S. San Pedro St., Los Angeles, Calif. It is made in various types, models, sizes, and in stroke lengths to meet practically all requirements. 122

Standardized Cylinder Made by Engineering Products Co.

Flux-Coated Bronze Welding Rods

A new flux-coated bronze welding rod designed for application by the oxy-acetylene process has been developed by The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York 17, N. Y. This No. 25M patented welding rod is said to combine all the desirable properties of the Oxweld No. 25M bare bronze rod with the advantage of the flux coating. The flux coating, consisting of Brazo flux plus a non-active binder that does not affect the weld, adheres firmly to the rod and melts down into the molten puddle without burning ahead of the rod. The rod can be heated and bent without destroying the coating, which is unaffected by weather conditions.....123

* * *

A V-2 rocket bomb develops 52,000 H.P.

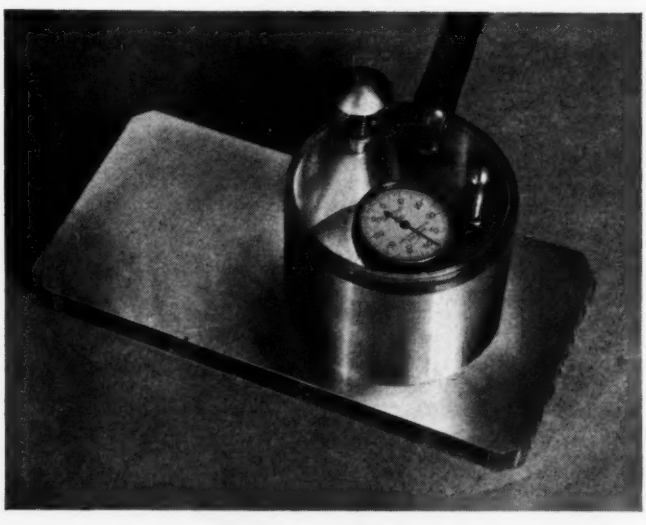
Gage for Inspecting Bonds of Laminated Materials or Measuring Sheet Thickness

Development of an instrument gage that is a new approach to the measurement of the thickness of sheet metal has been announced by the Glenn L. Martin Co., Baltimore 3, Maryland. The gage can also be used for inspecting the bonds between layers of laminated materials.

Operating on the pressure principle, the gage consists of an inverted cup-shaped shell, with the top wall of transparent material and the bottom rim edged with a rubber gasket. Mounted inside the shell is a dial indicator equipped with a stem reaching to a spherical-shaped foot, as shown in the accompanying illustration. In use, this foot rests against the surface to be measured or inspected. A valve in the top of the case is connected to an exterior pump, so that the air inside the gage can be withdrawn.

In applying the instrument for inspecting laminated materials, the gage is placed on the area to be inspected, the valve is opened, and the air inside the instrument is allowed to reach normal atmospheric pressure. A reading is then taken, which is used as a standard for the test. With the valve again closed, the air is evacuated. Should there by a faulty bond between the surface sheet and the adjacent layers, the area of the top sheet covered by the gage will pull away from the other layers, against the foot of the gage, and a deflection will register on the dial. The instrument may be calibrated for the number and thickness of layers of different materials, so that a certain deflection of the gage will indicate a faulty bond in a particular layer.

The application of the gage for inspecting the thickness of a single sheet of material is particularly advantageous in the case of large sheets, where the measuring of central areas would be impossible with micrometers. In measuring the thickness of sheet metal, the pressures recorded during the test are checked against predetermined gage readings for each thickness of the metal.



Gage Developed by the Glenn L. Martin Co., for Inspecting Bonds and Measuring Sheet Thicknesses of Various Materials

* * *

Aids in Making Three-Dimensional Drawings

A new accessory for the draftsman is furnished by the Instrumaster Industries, 73-59 Arch St,, Greenwich, Conn., in the form of "stencil" type instruments intended for use in making isometric drawings. These are made from a clear plastic stock, 0.040 inch thick, with graduations and lettering impressed on the under side. The draftsman can make isometric drawings easily by using these stencils alone, without resorting to other instruments. Similar instruments are also available for making dimetric drawings.

* * *

United States Government Educational Films

What is believed to be the largest single collection of educational films available to schools and industries is described in a new catalogue just published and offered free to users of training films by Castle Films, Inc., 30 Rockefeller Plaza, New York City. The catalogue contains a complete list of all the U. S. Government 16-millimeter sound films and 35-millimeter film strips, totaling 1158. They include 466 motion pictures and 432 film strips of the U. S. Office of Education, as well as training films and other types of educational films produced by the Navy, War Department, Department of Agriculture, and the U. S. Public Health Service.

To obtain additional information on equipment described on this page, see lower part of page 230.

Your automatic screw machines will operate longer between tool changes when you use J&L Cold Finished steel. The uniform Controlled Quality of J&L Cold Finished rounds, hexagons and squares makes it possible for you to set the speed of your machines to obtain maximum efficiency. In addition the close dimensions and inherent machinability of J&L Cold Finished bars will make it possible to produce, at low cost, accurate, highly finished parts.

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PITTSBURGH 30, PENNSYLVANIA

J&L STEEL

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 229 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the May, 1946, Number of MACHINERY

Air-Hydraulic Cylinders

LOGANSPORT MACHINE CO., INC., 910 Center Ave., Logansport, Ind. Catalogue 471, containing complete information on the new Logan "Air-Draulic" cylinders, including engineering data. Copies can be obtained without charge if requested on a business letter-head, addressed directly to the company.

Hydraulic Arbor Presses

K. R. WILSON, 215 Main St., Buffalo 3, N. Y. 32-page catalogue illustrating and describing the design and construction details of the hydraulic arbor presses made by this company in hand-, air-, and motor-operated types for a wide variety of production jobs. 1

Portable Surface Pyrometers

CAMBRIDGE INSTRUMENT CO., INC., 3068 Grand Central Terminal, New York 17, N. Y. Bulletin 194-SA, illustrating and describing portable surface pyrometers that indicate the temperature of flat and curved surfaces, still or moving, in accessible or hard-to-reach locations. 2

Resistance Welding Data

FEDERAL MACHINE & WELDER CO., 208 Dana St., Warren, Ohio. Bulletin SP H300, containing technical information on resistance welding, including welding pressures, time, current, etc., for welding various types of materials; covers spot, projection, seam, and flash welding. 3

Precision Surface-Finishing Equipment

COGSDILL TWIST DRILL CO., 12950 W. Eight Mile Road, Detroit 21, Mich. Bulletin descriptive of the Cogsdill "Bearing-izing" process for surface-finishing and sizing of holes, flat surfaces, round parts, and many contours. 4

Hard-Surfacing Technique

METAL & THERMIT CORPORATION, 120 Broadway, New York 5, N. Y. Technical bulletin covering hard-surfacing and the use of Hardex electrodes, including welding techniques, selection of proper rod, and other helpful data. 5

Tool Lubricating and Brushing Device

CHARLES L. JARVIS CO., Middletown, Conn. Circular descriptive of the Jarvis "Lubro Brush," a simple device for automatically lubricating and brushing the chips away from taps and other tools. 6

Cleaning and Drawing Compounds

NORTHWEST CHEMICAL CO., 9310 Roselawn, Detroit 4, Mich. Catalogue covering thirty-nine different cleaning and drawing compounds, some of the latter being designed for particularly heavy draws. 7

Equipment for Examining Surfaces

FAXFILM CO., 1220 W. 6th St., Cleveland 13, Ohio. Catalogue descriptive of the Faxfilm process and equipment, by means of which a variety of surfaces can be examined quickly with the naked eye.....8

Printing and Developing Machines

CHARLES BRUNING CO., INC., 4754 Montrose Ave., Chicago 41, Ill. Bulletin entitled "What's Your Postwar Problem?" illustrating and describing several types of printing and developing machines. 9

Polishing Equipment and Abrasives

CLOVER MFG. CO., Norwalk, Conn. Bulletin 3, entitled "Testing Coated Abrasives," by E. B. Gallaher. Bulletin 4, entitled "Belt Sanding of Metal—The Polishing Lathe," by the same author. 10

Prepared Gas Atmospheres for Heat-Treating

SURFACE COMBUSTION CORPORATION, Toledo 1, Ohio. Bulletin SC-129, containing information on the preparation and applications of various types of atmospheres used in heat-treating. 11

Radiant Heating

FOSTORIA PRESSED STEEL CORPORATION, Fostoria, Ohio. Bulletin EV 1245, entitled "Infra-Red Parade," showing typical applications of the Fostoria "Evenray" system for baking, drying, preheating, and dehydrating. 12

Spring Design Data

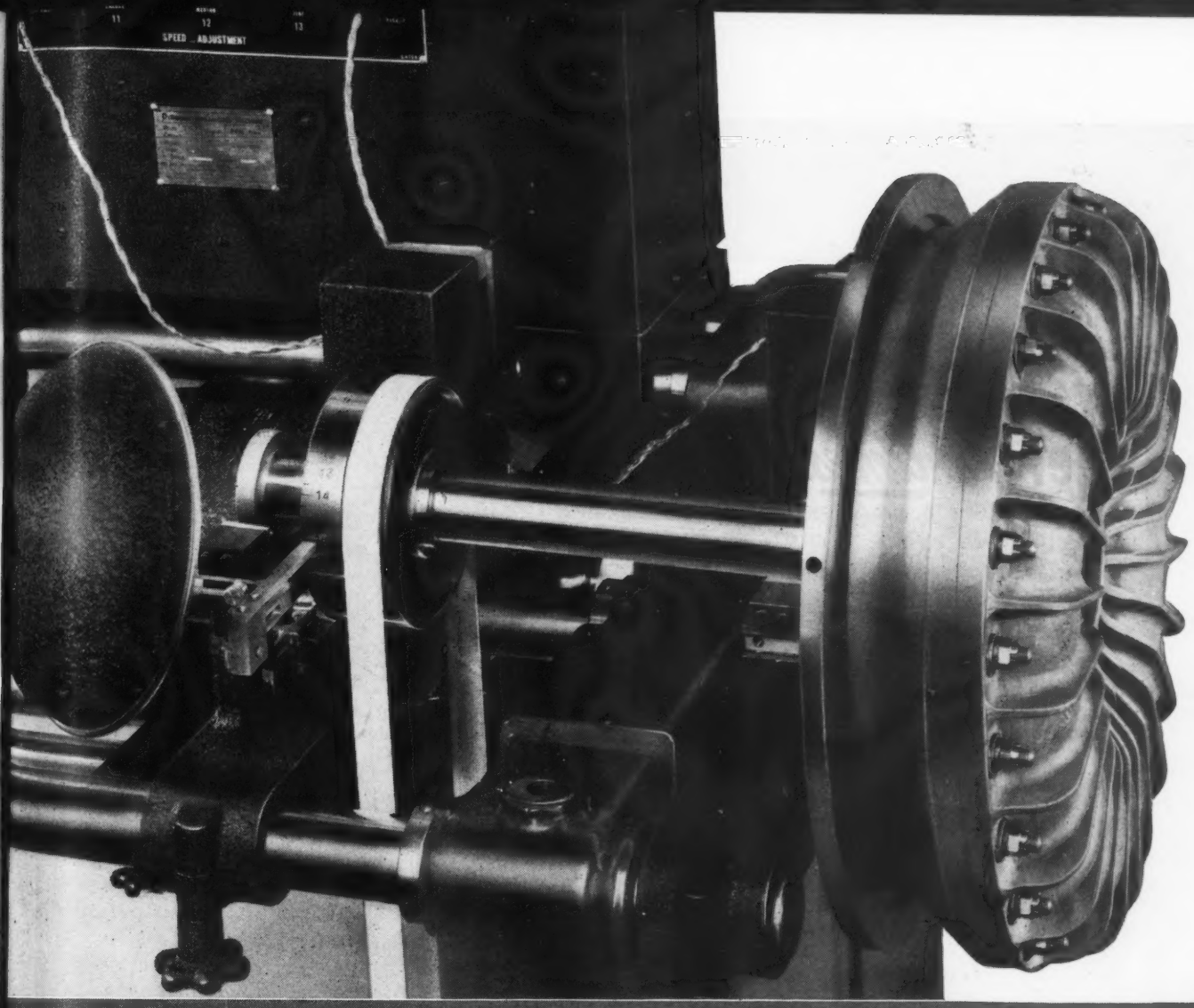
ALL-WEATHER SPRINGS, 140 Cedar St., New York 6, N. Y. Booklet entitled "Instrument Springs," containing technical information on the design and application of instrument springs, including load and deflection formulas. 13

Axles, Springs, Pumps, Valves, Etc.

EATON MFG. CO., RELIANCE DIVISION, Massillon, Ohio. Booklet illustrating and briefly describing the various products made by the company for the automotive, marine, and aircraft industries. 14

Meehanite Castings

MEEHANITE METAL CORPORATION, Pershing Square Building, New Rochelle, N. Y. Bulletin DM-145, describing actual case histories of the use of Meehanite in thread gages, upsetting dies, and precision machinery. 15



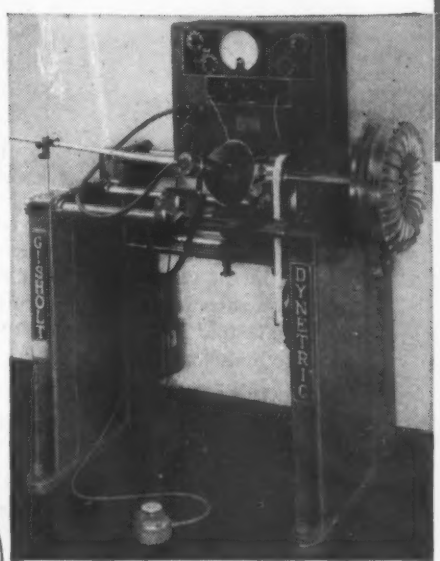
Smoothing out the Fluid Drive with GISHOLT DYNETRICS*

"Smooth as the flow of oil," describes the fluid drive. But this manufacturer goes all the way to make it the last word in smooth, vibrationless performance by balancing the assembly, too. And, of course, it's done on a Gisholt Dynetric Balancing Machine.

This is an out-of-the-ordinary application because, instead of balancing in the normal position between work supports, the cast aluminum fluid drive housing is balanced in an overhanging position. It's done this way to facilitate loading of the work piece and to make possible the easy application of unbalance corrections. This same arrangement is used for balancing axial flow fans, flywheels, and other parts of large diameter.

The basic principles used by the Gisholt Dynetrics make it possible to balance any size or shape of part to any desired accuracy. Write for literature.

**A development of Westinghouse Research Laboratories.*



This Gisholt 1-S Dynetric is arranged for balancing a fluid flywheel, or torque converter, as shown on the work support.

GISHOLT MACHINE COMPANY

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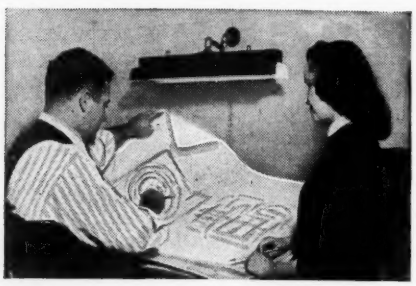
With Gisholt Improvements

"How come the draftsmen get *65 times* faster service?"



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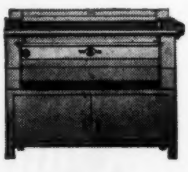

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Grinding and Lapping Machines

NORTON Co., Worcester 6, Mass. Catalogue 1843-5, illustrating and describing the various types of Norton grinding and lapping machines. 16

Production Parts

EX-CELL-O CORPORATION, 1200 Oakman Blvd., Detroit 6, Mich. Bulletin 36151, describing the facilities of the company for supplying production parts for new and improved products. 17

Surplus Machine Tools

PRATT & WHITNEY DIVISION NILES-BEMENT-POND Co., West Hartford 1, Conn. Folder entitled "How to Locate the Pratt & Whitney Machines You Need in the U. S. Government Surplus Stocks." 18

Precision Circular Form Tools

HARDINGE BROTHERS, INC., Elmira, N. Y. Bulletin F, containing complete specifications covering Hardinge precision ground circular form tools for automatics, chucking machines, and turret lathes. 19

Tachometers

HERMAN H. STICHT Co., INC., 27 Park Place, New York 7, N. Y. Condensed bulletin 1045, showing nine different types of tachometers supplied by this company. 20

Abrasive Wheels

KEYSTONE ABRASIVE WHEEL, INC., Carnegie, Pa., is publishing a new house organ called *Keystone Abrasive Times*, which will contain articles of interest to those concerned with grinding wheels. 21

Vibration Dampener Bushing for Grinding Wheels

MANHATTAN RUBBER DIVISION OF RAYBESTOS-MANHATTAN, INC., Passaic, N. J. Bulletin 6878, on V.D.B. resilient mountings for Manhattan wheels used on portable grinders...22

Control Valves for Air and Hydraulic Cylinders

HANNA ENGINEERING WORKS, 1765 Elston Ave., Chicago 22, Ill. Catalogues covering Hanna 1/4-inch control valves; foot-operated valves; and two-direction speed control valves...23

Press Counting-Guard

W. H. SEARJEANT Co., 89 Allen St., Rochester 6, N. Y. Bulletin 125, descriptive of a new type of power press safety guard provided with a counting feature for recording the number of stampings produced.....24

Hand Screw Machines

WADE TOOL Co., 52 River St., Waltham 54, Mass. Catalogue illustrating and describing the construction of two new models of the Wade hand screw machine designed for second-operation work. 25

Tap Extractors

WALTON Co., 94 Allyn St., Hartford 3, Conn. Folder 152, describing the complete line of Walton tap extractors. 26

Radius-Grinding Attachment

CINCINNATI MILLING MACHINE Co., Cincinnati 9, Ohio. Catalogue M-1442, containing specifications on Cincinnati No. 2 radius-grinding attachment, as well as instructions for setting up. 27

Hydraulic Planers

ROCKFORD MACHINE TOOL Co., Rockford, Ill. Bulletin 150, illustrating and describing the design, construction, and operation of the Hy-Draulic open-side planer. 28

Ampco Products

AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 4, Wis. Bulletin 69, on continuous cast bronze rod and tubing. Bulletin 80, on Ampco metal guide post bushings. 29

"Truforming" Grinders

THOMPSON GRINDER Co., INC., Springfield, Ohio. Catalogue illustrating and describing a new crush form grinding process known as "Truforming." 30

Cone-Drive Gear Sets

MICHIGAN TOOL Co., 7171 E. McNichols Road, Detroit 12, Mich. Catalogue 700, describing ninety-nine sizes and ratios of standardized cone-drive gear sets. 31

Collet Tools

ZAGAR TOOL, INC., 23880 Lakeland Blvd., Cleveland 17, Ohio. Catalogue covering the Zagar line of collet tools, broaching machines, and multiple drill heads. 32

To Obtain Copies of New Trade Literature

listed on pages 226-230 (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue to:

MACHINERY, 148 Lafayette St., New York 13, N. Y.

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[SEE OTHER SIDE]

Injection Molding Machines

WATSON - STILLMAN CO., Roselle, N. J. Bulletin describing Watson-Stillman one-ounce injection molding machine for experimental work and short-run jobs. 33

Flexible Couplings

GEAR GRINDING MACHINE CO., Detroit 11, Mich. Folder illustrating and describing the Ballflex angular and axial anti-friction flexible coupling. 34

Universal Miller-Shaper

COCHRANE-BLY CO., Rochester 6, N. Y. Bulletin entitled "A Machine of 1000 Production Uses," illustrating and describing the Cochrane-Bly universal vertical miller-shaper.....35

Carbide-Tipped Face Mills

TUNGSTEN CARBIDE TOOL CO., 2661 Joy Road, Detroit 6, Mich. Bulletin FM-46, describing the new "Vibra-Cushioned" carbide- tipped face mills designed for face-milling steels.....36

Carbide Tool Grinders

WILLEY'S CARBIDE TOOL CO., 1340 W. Vernor Highway, Detroit 1, Mich. Bulletin descriptive of Willey's Model 50-A carbide tool grinder equipped for wet and dry grinding.....37

Heat- and Corrosion-Resistant Castings

NATIONAL ALLOY STEEL DIVISION OF BLAW-KNOX CO., Blawnox, Pa. Catalogue 2041, on the heat- and corrosion-resistant alloys produced by this company. 38

Pneumatic Bar Feeds

LIPE-ROLLWAY CORPORATION, Syracuse 1, N. Y. Circulars illustrating and describing the Lipe pneumatic bar feed for multiple-spindle automatics and hand screw machines...39

Collets and Feed-Fingers

SUTTON TOOL CO., Sturgis, Mich. Catalogue 16, covering the Sutton line of collets and feed-fingers for automatic and hand screw machines, lathes, and milling machines. 40

Tool Steel

CRUCIBLE STEEL CO. OF AMERICA, 405 Lexington Ave., New York 17, N. Y. Data Sheet 112, covering composition, applications, and heat-treatment of HYCC tool steel. 41

Duplicating Attachment

BAILEY METER CO., 1050 Ivanhoe Road, Cleveland 10, Ohio. Bulletin CC-2, illustrating and describing the Bailey duplicating attachment for machine tools. 42

Copper Welding and Brazing

C. E. PHILLIPS & CO., INC., 2750 Poplar St., Detroit 8, Mich. Handbook on welding and brazing of copper and copper alloys, covering materials and procedures. 43

Metallurgical Service

SAM TOUR & CO., INC., 44 Trinity Place, New York 6, N. Y. Bulletin entitled, "Go Forward with Metallurgical Answers," outlining the metallurgical services offered by this concern. 44

Push-Broaches

EAST SHORE MACHINE PRODUCTS CO., 835 E. 140th St., Cleveland 10, Ohio. Bulletin 9, on the Glenny adjustable expansion push-broach for keyway cutting. 45

Carbide Tools

METRO TOOL & GAGE CO., 4240 Peterson Ave., Chicago 30, Ill. Catalogue on Metro standard carbide tools, including specifications. 46

Flow Meters

BRISTOL CO., 161 Bristol Road, Waterbury 91, Conn. Bulletin F1603, describing the Bristol bellows-differential flow meter. 47

Cast-to-Shape Steels

JESSOP STEEL CO., Washington, Pa. Catalogue containing data on the applications and heat-treatment of Jessop cast-to-shape steels. 48

Rebuilt Machine Tools

MILES MACHINERY CO., Saginaw, Mich. Catalogue 182, listing many types of guaranteed rebuilt machine tools. 49

Live Centers

STURDIMATIC TOOL CO., 5220 Third Ave., Detroit 2, Mich. Bulletin 146, on standard and special "engineered" live centers. 50

Belt-Conveyor Furnaces

W. S. ROCKWELL CO., 200 Eliot St., Fairfield, Conn. Bulletin 421, on Rockwell belt-conveyor continuous heat-treating furnaces. 51

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 193-224 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in May, 1946, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

Detach and mail to MACHINERY, 148 Lafayette St., New York 13, N. Y.

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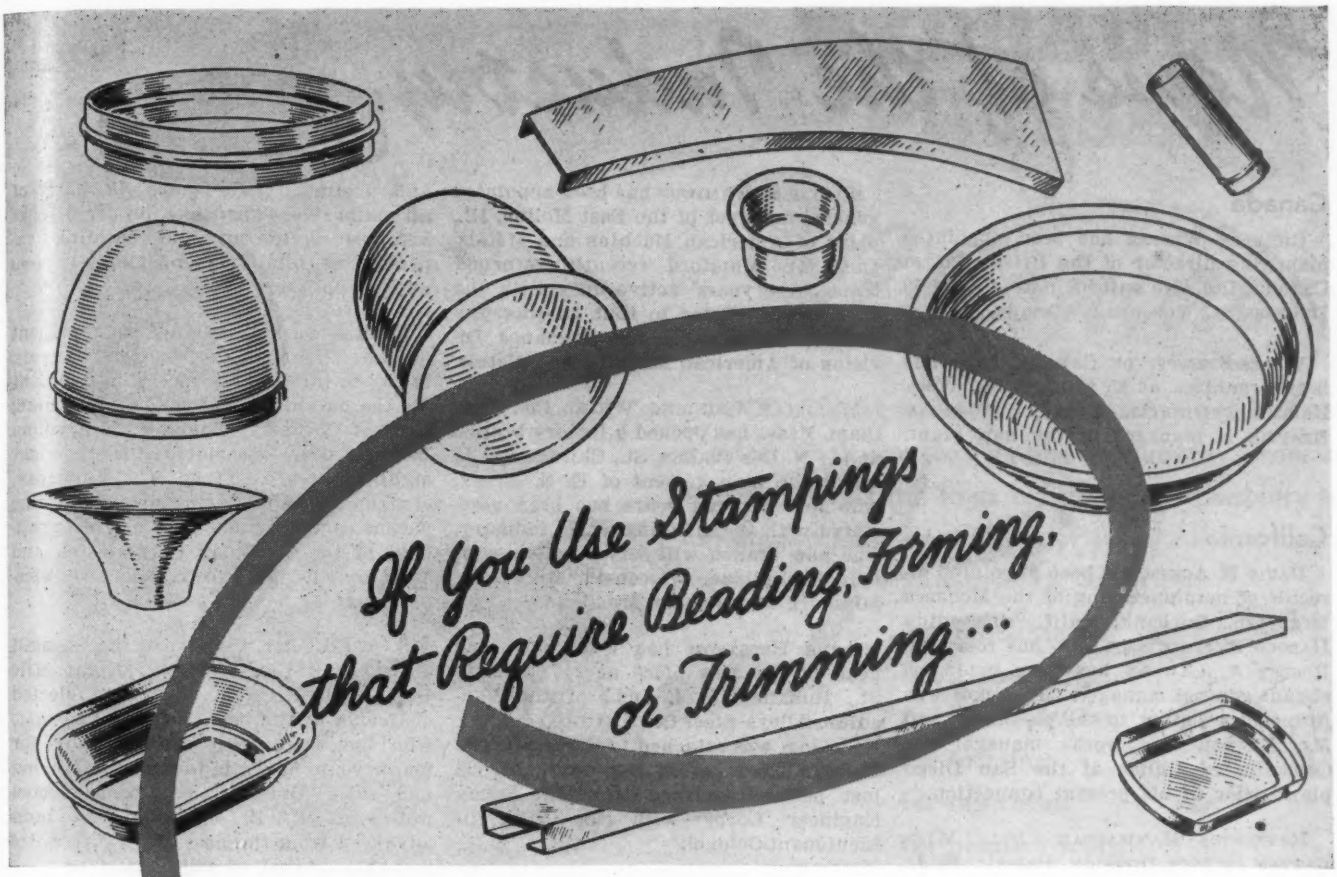


YOU CAN SAVE TIME and CUT COSTS
with this NEW Stamping Trimmer

Quickwork stamping trimmers, specially adapted to each particular job, handle almost any type of stamping in a single plane—trimming, forming or beading large or small stampings with or without flash, and cutting steel, aluminum alloy, and stainless steel with ease. With the Quickwork stamping trimmer, these operations are reduced to seconds.

It will save valuable press time and eliminate the need for expensive trimming dies. Check the possibilities for removing your production bottlenecks; write for Bulletin QW-119.

WHITING
CORPORATION

15673 LATHROP AVENUE, HARVEY, ILLINOIS
Export Department: 30 Church Street, New York 7, N. Y.

News of the Industry

Canada

CHARLES WEBBER has been appointed managing director of the Bristol Co. of Canada, Ltd. He will be located at 71-79 Duchess St., Toronto 2, Canada.

WALES-STRIPPIT OF CANADA, LTD., has been organized at 85 Cannon St., West, Hamilton, Ontario, Canada. WILLIAM BEATTIE is manager of the new plant.

California

DAVID B. ACKER has been appointed director of manufacturing of the Menasco Mfg. Co., Burbank, Calif., succeeding HAROLD F. SCHWEDGE, who has resigned. ROBERT A. LAWSON has been made assistant general manager. Mr. Acker was formerly assistant to the president, and Mr. Lawson was works manager for Consolidated Vultee at the San Diego plant prior to his present connection.

RAYBESTOS-MANHATTAN, INC., MANHATTAN RUBBER DIVISION, Passaic, N. J., has appointed the REPUBLIC SUPPLY CO. of California distributor of Manhattan industrial rubber products. Headquarters of the company are in San Francisco.

HAROLD L. ADAMSON has been appointed factory representative in the San Francisco, Calif., area for the Wales-Strippit Corporation, North Tonawanda, N. Y., manufacturer of punching and notching equipment.

RAYMOND L. SEITZ has joined the West Coast sales engineering staff of Foote Bros. Gear & Machine Corporation. He will be located at Pasadena, Calif.

Illinois and Indiana

CINCH MFG. CORPORATION, 2335 W. Van Buren St., Chicago, Ill., announces the purchase of the HOWARD B. JONES CO., 2460 W. George St., Chicago, manufacturer of electrical connecting devices. The plant will be known as the HOWARD B. JONES DIVISION, and will continue to manufacture the same line of products. CARY WILSON, vice-president of the Cinch Mfg. Corporation, becomes general manager of the new organization.

CHARLES L. SAUNDERS, vice-president of the Wheelco Instruments Co., 847 W. Harrison St., Chicago, Ill., has been appointed executive vice-president; CLAUDE A. GATES and C. H. JOY, zone managers of the company, have been made vice-presidents; and R. A. SCHOENFELD, now a vice-president, has been named a director of the company.

PHILIP S. MUMFORD has been appointed general manager of the East Moline, Ill., plant of American Machine and Metals, Inc. Mr. Mumford recently returned from three years' active duty with the U. S. Navy. Prior to that he was production manager of the Ordnance Division of American Machine and Metals.

WALTHAM GRINDING WHEEL CO., Waltham, Mass., has opened a factory branch at 114 N. Des Plaines St., Chicago 6, Ill., under the management of E. S. AVERY, who for over ten years has been associated with the grinding wheel industry. The new branch will serve the states of Illinois, Indiana, Wisconsin, Minnesota, Missouri, and western Michigan.

ARNE HEDSTROM has been appointed head of the new office at 243 E. Ohio St., Indianapolis 4, Ind., of the Vanadium-Alloys Steel Co., Latrobe, Pa. Mr. Hedstrom was attached to the company's Chicago office before the war. He has just been discharged from the Army Engineer Corps with the rank of Lieutenant-Colonel.

Maryland and South Carolina

C. RIDER BRANDAU has been made manager of sales of the Lukens Steel Co., and its subsidiaries, By-Products Steel Corporation and Lukenweld, Inc., Coatesville, Pa., for the Baltimore district. He succeeds ADOLPH RIDER, JR., who has resigned. Mr. Brandau has been connected with the company since 1924.

RHEEM RESEARCH PRODUCTS, INC., announce the removal of their manufacturing and sales facilities from the Standard Oil Building, St. Paul and Franklin Sts., Baltimore 2, Md., to 4004 E. Monument St., Baltimore 5, Md.

JONES Y. PHARR, JR., has been designated southern representative for the ball bearings made by New Departure Division General Motors Corporation, Bristol, Conn. Mr. Pharr will make his headquarters in Charlotte, S. C., and will cover the territory comprising North and South Carolina, Georgia, and Alabama.

Michigan

E. W. BLISS CO., manufacturer of stamping presses, rolling mills, and can-making machinery, announces that the executive offices of the company have been transferred from Brooklyn, N. Y., to 450 Amsterdam St., Detroit, Mich. The company will maintain its manufacturing division in the Bush Terminal in Brooklyn, as well as its various plants throughout this country and in England and France. This move is part of an extensive expansion program that involves equipment and building expenditures totaling approximately two million dollars.

H. MANDEL has resigned as president of the Wickman Corporation, Detroit, Mich., to take over a special assignment for the parent company, A. C. Wickman, Ltd., of Coventry, England, with whom he has been associated for the last eighteen years. AXEL C. WICKMAN, chairman and managing director of the parent company, has been elected president of the Wickman Corporation, and WILLIAM T. MUIRHEAD executive vice-president.

S. A. COGSDILL, founder of the Cogsdill Twist Drill Co., 12950 W. Eight Mile Road, Detroit, Mich., has been elected chairman of the board. FLOYD COGSDILL, who has been with the company for many years in both the manufacturing and sales divisions, has been elected president. C. B. STOERKEL has been advanced from the post of division sales manager to that of sales manager.

CARBOLOY COMPANY, INC., Detroit, Mich., has appointed the MACHINISTS' TOOL & SUPPLY CO., 3690 Sante Fe Ave., Los Angeles 11, Calif., distributor for Carboloy tools in the southern California area, and the MANUFACTURERS RUBBER & SUPPLY CO., 380 S. Broadway, Akron 8, Ohio, distributor in the north central Ohio area.

MARQUETTE MACHINERY CO., Detroit, Mich., announces the removal of its offices to enlarged quarters at 2406 Guardian Building of the same city. The company specializes in securing Government-owned surplus machine tools, serving purchasers by obtaining either single machines or the equipment for an entire plant.

SUPERDRAULIC CORPORATION, Dearborn, Mich., announces the appointment of the following officers: President and general manager, HARRY L. WISE; treasurer, ROBERT W. WISE; vice-president in charge of engineering, JAMES HOFFER; vice-president and director of sales and advertising, TED NAGLE; and secretary, JOHN R. DAVIS.

WILLIAM SCOTT ASSOCIATES, consultants in the fields of management, marketing, and manpower development, have moved their Detroit offices from the Dime Building to the Guardian Building.

E. H. H. GRAF, who has been associated with the Oilgear Co., of Milwaukee, Wis., as Detroit district manager for the last thirteen years, has been appointed sales manager of the U. S. Broach Co., Detroit, Mich.

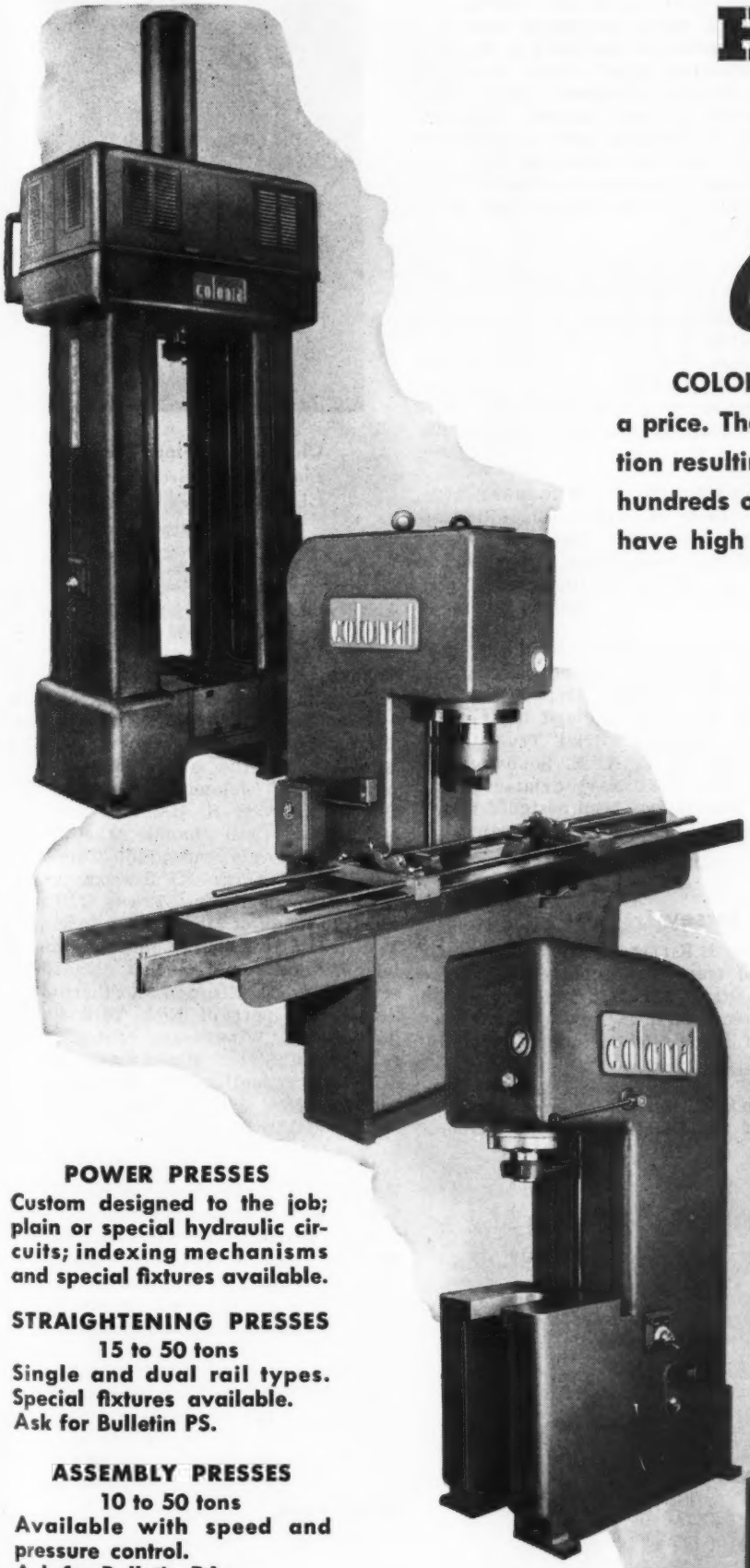
HYDRAULIC PRESSES

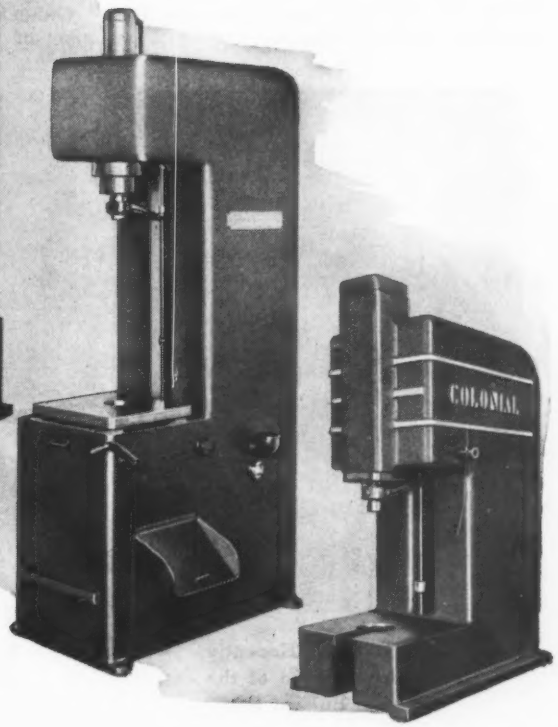
by

Colonial

COLONIAL hydraulic presses are not built to a price. Their low cost is due to quantity production resulting from their universal applicability to hundreds of different types of jobs. All machines have high overload reserve capacity.

For broaching
for assembling
for straightening
for forming
for punching
for plastics work
for aluminum and magnesium





colonial
BROACH COMPANY
Box 37, Harper Station Detroit 13, U. S. A.

POWER PRESSES
Custom designed to the job; plain or special hydraulic circuits; indexing mechanisms and special fixtures available.

STRAIGHTENING PRESSES
15 to 50 tons
Single and dual rail types.
Special fixtures available.
Ask for Bulletin PS.

ASSEMBLY PRESSES
10 to 50 tons
Available with speed and pressure control.
Ask for Bulletin PA.

"UTILITY" PRESSES
4 to 10 tons
Available with speed, pressure and dual safety controls; pulldown attachment.
Ask for Bulletin VBS.

"JUNIOR" PRESSES
1 to 4 tons
Available with pedestal and with straightening or pulldown attachment.
Ask for Bulletin VJ-1.

New England

NEW BRITAIN-GRIDLEY MACHINE DIVISION, NEW BRITAIN MACHINE CO., New Britain, Conn., announces the appointment of the following sales engineers: FRANK H. HASTINGS, western Ohio, Indiana, and northern Kentucky, with headquarters in Dayton, Ohio; CHARLES W. COFFIN and WILLIAM H. NETTLE in the Michigan territory, with headquarters at 3-212 General Motors Bldg., Detroit, Mich.

H. A. VAN HALA has been made district manager of the Cleveland office of the Bristol Co., Waterbury 91, Conn., succeeding G. H. GAITES, who became manager of the New York office last January. Mr. Van Halà is being transferred from the Birmingham office, where he has been district manager since 1935. His headquarters will be in the Engineer's Building, Cleveland 14, Ohio.

THEODORE G. HUGHES has been made factory manager of the Norma-Hoffmann Bearings Corporation, Stamford, Conn. Mr. Hughes was formerly superintendent of the S K F Gwynedd plant at Lansdale, Pa.

E. C. BULLARD, vice-president and general manager of the Bullard Co., Bridgeport 2, Conn., for the last fifteen years, has been elected president of the company, succeeding to the position held for nearly forty years by E. P. BULLARD, whose father founded the firm. The retiring president, a pioneer in the machine tool industry and one of the early leaders in industrial education, has been elected chairman of the board of directors. All the directors of the company were re-elected at the annual meeting. GEORGE L. TODD, comptroller, was advanced to a vice-presidency, and E. P. BULLARD III, vice-president in charge of manufacturing, was appointed assistant general manager.

GREENFIELD TAP & DIE CORPORATION, Greenfield, Mass., announces that at a recent meeting of the board of directors the following officers were re-elected: D. G. MILLAR, president; H. L. BILL, vice-president and general manager; and W. J. EBERLEIN, general sales manager. It was also announced that S. S. BERGER has resigned as a director. T. E. BRAGG and F. B. PAYNE have been added to the board.

L. E. LYNDE has been appointed manager of the New England district of the Westinghouse Electric Corporation, Pittsburgh 30, Pa., with headquarters at Boston, Mass. F. L. NASON, heretofore New England district manager, will become a special representative of the company in the New England district.

ALLEN-BRADLEY CO., Milwaukee, Wis., manufacturer of electric controlling apparatus, announces that the Boston office of the concern has been moved to larger quarters at 55 Oliver St. M. H. HALLENBECK remains district manager.

R. H. PORTERFIELD has been appointed manager of a new branch office of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., in the New England district, located at 1607 Industrial Trust Bldg., Providence, R. I. R. E. SCUDDER, who served as a U. S. Navy aviator during World War II, has been assigned to the Providence branch as a salesman.

New Jersey

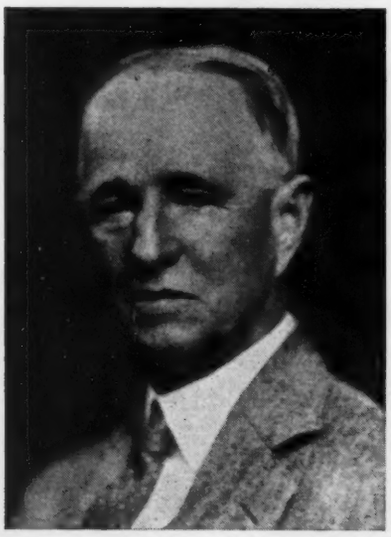
DANIEL J. KILLFOILE, who was recently released from the Signal Corps of the United States Army, in which he served for three years, is now on the sales staff of Alloy Steel Products Co., Linden, N. J.

CHARLES E. HEINTZ, general sales manager of the Elastic Stop Nut Corporation of America, Union, N. J., for the last two years, has been elected vice-president in charge of sales.

Charles E. Heintz, Newly Elected Vice-president in Charge of Sales of Elastic Stop Nut Corporation

NATIONAL OIL PRODUCTS CO., Harrison, N. J., announces the following changes in its industrial sales department: THOMAS J. CAMPBELL, who recently returned from the armed forces, will cover Long Island, Brooklyn, and Queens; DANIEL S. RION, another ex-serviceman, will handle the South Carolina, Georgia, and middle Tennessee territory; WALTER E. BREWER, northeastern Pennsylvania; FRANK J. CHADWICK, Borough of Manhattan; LAWRENCE E. ROSSITER, eastern Connecticut, Rhode Island, and southeastern Massachusetts; NEIL E. ELPHICK, northern New Jersey and part of New York State; THOMAS D. WILKINSON, central New Jersey and Staten Island; and ALFRED M. HARTLEY, southeastern Pennsylvania, southern New Jersey, Delaware, Maryland, and Virginia.

WRIGHT AERONAUTICAL CORPORATION, Paterson, N. J., has been notified by the War Assets Corporation that its proposal to purchase the Wood-Ridge, N. J., plant in which it built more than 10,000 Cyclone 18 aircraft engines for Boeing Superfortresses has been approved by the Government agency. The plan is to consolidate in the new plant all manufacturing and office facilities that were formerly located in buildings scattered through the Paterson area.



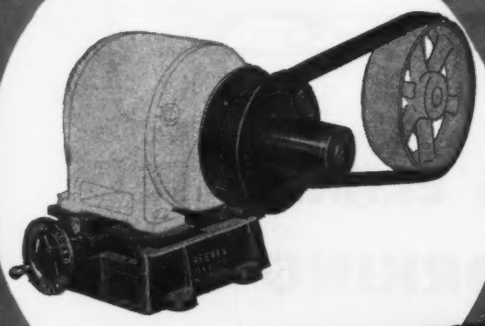
E. P. Bullard, Recently Elected Chairman of the Board of Bullard Co.

E. C. Bullard, Newly Elected President of the Bullard Co.

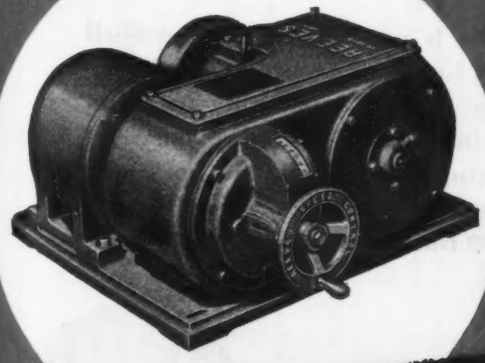
New York

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York 5, N. Y., announces the opening of the Empire State Technical Section of its Development and Research Division. It is located in the Genesee Valley Trust Bldg., Exchange and Broad Sts., Rochester 4, N. Y., and will furnish technical information to industry in the state of New York, excluding New York City, the Albany

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed adjustability over wide range —2:1 to 16:1 inclusive. In sizes to 87 h.p.



VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive within 4:1 ratio. In sizes to 15 h.p.



MOTODRIVE combines motor, speed varying mechanism and reduction gears in single unit. Sizes to 15 h.p. in ratios of speed variation from 2:1 to 6:1

these 3 units

MADE INDUSTRY SPEED CONTROL MINDED

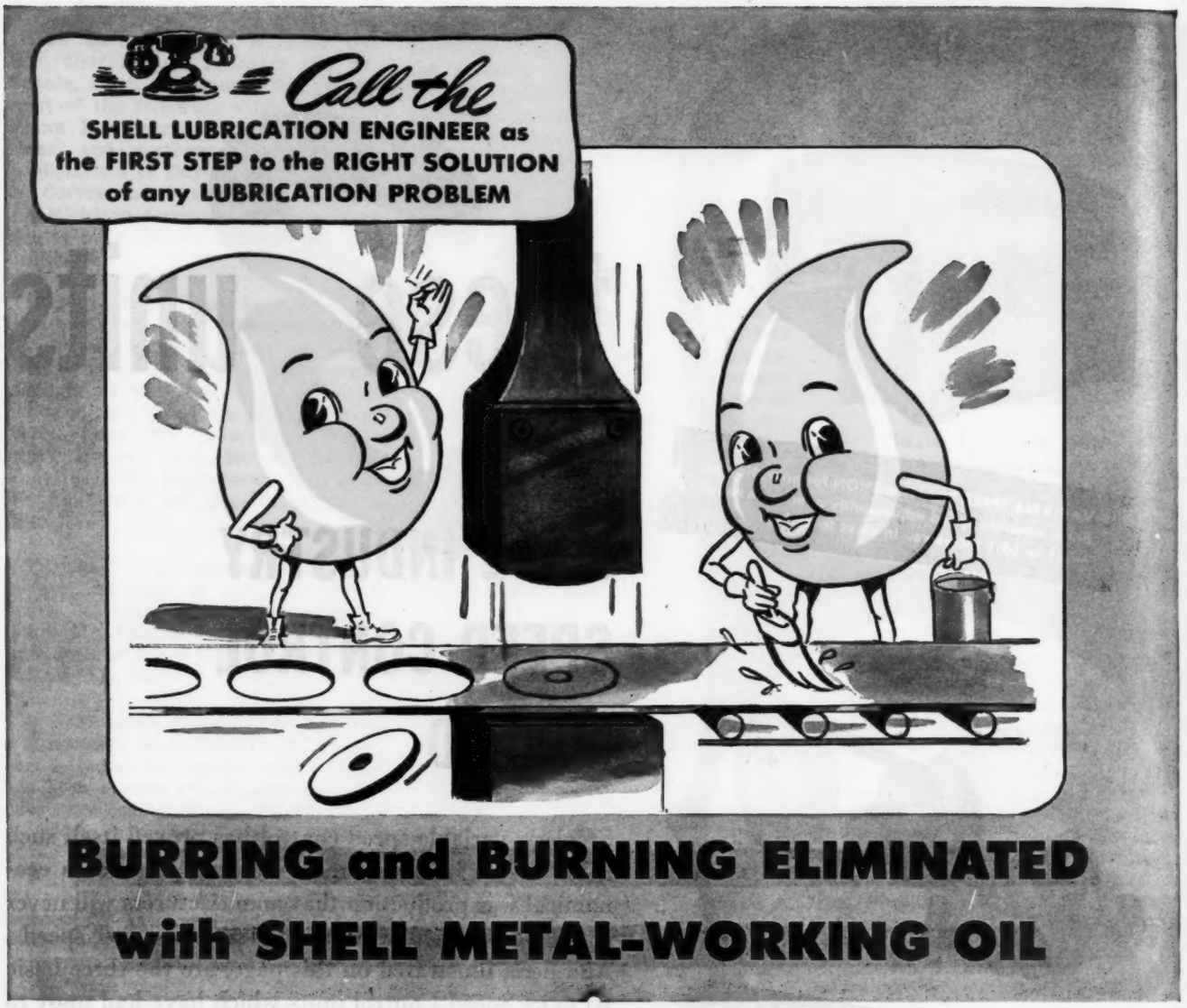
Stepless, variable speed control has proved itself such a big factor in faster, more accurate and more economical war production that manufacturers will never again be satisfied with machines with fixed speeds. And here, illustrated on this page, are the three basic REEVES Speed Control units which have had most to do with this important development. More than 300,000 REEVES units are now in service. They are standard equipment on 1,866 different makes of machines.

No other speed control offers so many sizes and types to choose from—is so fool-proof and reliable. No other has the nation-wide staff of representatives, so thoroughly trained in this specialized field of engineering. Look for the familiar REEVES handwheel on any new machine you buy. It is your assurance of greater versatility, uniform quality and larger output of production. Easily installed, too, on any driven machine in service. Write for Catalog M-450.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering

REEVES Speed Control



BURRING and BURNING ELIMINATED with SHELL METAL-WORKING OIL

PROBLEM: Stainless-steel strip, 3" wide, ¼" thick (Type 4 SAE-51710), was used for simultaneous blanking and piercing butterfly valve parts with a mechanical-ram, sheet-metal press at the rate of 120 blanks per minute. *Unlubricated strip produced badly burred blanks—die was dangerously overheated.* Slower speed would solve heat problem but not burring.

SOLUTION: When the Shell Lubrication Engineer surveyed the problem he recommended a Shell Garia Oil. This was applied with a paint brush to the top of the strip, just ahead of the stamping. All burring and overheating ceased. Manufacturer completed 60,000 valve parts, at the rate scheduled, without renewing dies.

CONCLUSION: It pays to consult the Shell Lubrication Engineer, regardless of the nature or size of your lubricating problem. Write for informative literature on Shell Metal-Working Oils. Shell Oil Company, Incorporated, 50 W. 50th St., New York 20, N. Y. or 100 Bush St., San Francisco 6, Cal.

SHELL METAL-WORKING OILS

For every metal . . . for every operation

SHELL

PROPERTIES OF ALUMINUM ALLOYS FOR PERMANENT-MOLD CASTINGS—1

Aluminum Co. of America's Alloy and Heat-Treatment Numbers	Yield Point, 0.2 Per Cent Set, Pounds per Square Inch	Ultimate Tensile Strength, Pounds per Square Inch	Elongation in 2 Inches, Per Cent	Brinell Hardness, 500-Kg. Load, 10-mm. Diameter Ball
43	9000	24,000	9.0	45
	Characteristics and Typical Applications			
	Especially suited for intricate and thin-walled castings and castings required to be leakproof. Has a high resistance to corrosion and can be welded easily, but is not as easy to machine as some of the other aluminum alloys. Alumilite coatings have a gray color, but are easily applied and offer excellent protection to severely corrosive conditions. This alloy has been used extensively in architectural and marine applications.			
C113	28,000	30,000	1.0	80
	Characteristics and Typical Applications			
	Can be cast easily in normal section thickness, but is not as well suited for thin sections as 43 or 356 alloys. Can be machined more easily than most of the other aluminum alloys. Has been used to a considerable extent for water-cooled cylinder heads and washing machine agitators.			
A132-T551	28,000	36,000	0.5	105
	Characteristics and Typical Applications			
	Used extensively for pistons because of good strength at temperatures of about 500 to 600 degrees F. and about 15 per cent less thermal expansion than most other aluminum alloys. Alumilite coatings increase resistance to abrasion.			
138	24,000	28,000	0.5	100
	Characteristics and Typical Applications			
	Retains hardness well at elevated temperatures and can be cast fairly easily. Can be polished to produce smooth surface with rather high luster. Used principally for sole plates for domestic electric irons.			

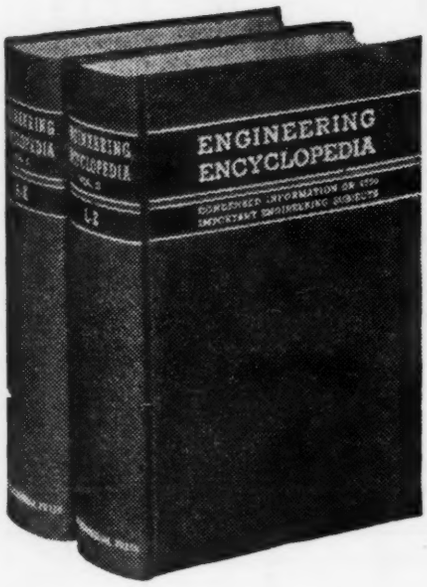
MACHINERY'S Data Sheet No. 561, May, 1946
Compiled by the Aluminum Co. of America, Pittsburgh, Pa.

PROPERTIES OF ALUMINUM ALLOYS FOR PERMANENT-MOLD CASTINGS—2

Aluminum Co. of America's Alloy and Heat-Treatment Numbers	Yield Point, 0.2 Per Cent Set, Pounds per Square Inch	Ultimate Tensile Strength, Pounds per Square Inch	Elongation in 2 Inches, Per Cent	Brinell Hardness, 500-Kg. Load, 10-mm. Diameter Ball
B195-T6	33,000	45,000	5.0	90
	Characteristics and Typical Applications			
	Combines good foundry characteristics with good physical properties and resistance to shock, a very good machinability and a good resistance to corrosion. Alumilite coatings have a milky appearance, but afford considerable protection. A commonly used, heat-treatable alloy for structural applications.			
A214	16,000	27,000	7.0	60
	Characteristics and Typical Applications			
	Has a very high resistance to corrosion and can be machined more easily than most other aluminum alloys. Alumilite coatings are clear and have an attractive appearance. Is less easily cast than most of the other alloys. Used chiefly for cooking utensils.			
355-T6	27,000	43,000	4.0	90
	Characteristics and Typical Applications			
	Can be cast easily and is quite useful for leakproof castings requiring good strength. Can be welded with ease, but should be reheat-treated after welding if full strength is important. Alumilite coatings are gray to milky in color. Has a good resistance to corrosion and a fairly good machinability. Used extensively for internal combustion engine parts and structural castings.			
356-T6	27,000	40,000	5.0	90
	Characteristics and Typical Applications			
	Casts well into thin sections and is frequently used when leakproof castings of relatively high strength are required. Has a high resistance to corrosion, but is not as easily machined as a number of the other alloys. Alumilite coatings have a gray color and afford a high degree of protection. Has been used extensively for aircraft wheels, truck frame parts, Diesel engine parts, and many intricate, thin-walled castings.			

MACHINERY'S Data Sheet No. 562, May, 1946
Compiled by the Aluminum Co. of America, Pittsburgh, Pa.

A World of Engineering Knowledge in Two Volumes



1431 pages, 4500 subjects

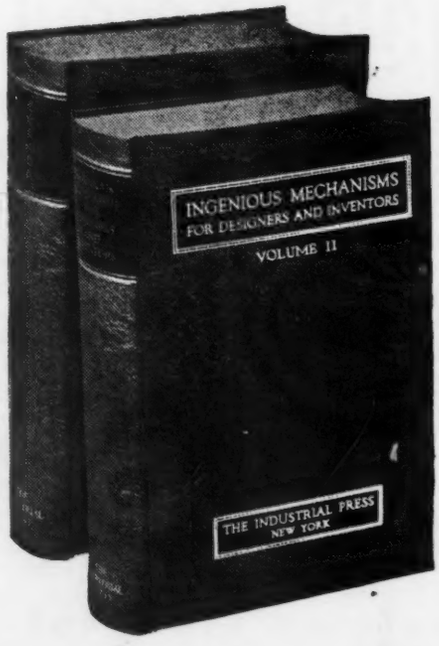
The Engineering Encyclopedia is for everyone who can use essential facts about thousands of standard and special engineering subjects. It consists of clearly written concise treatises, definitions of terms used in engineering and manufacturing practice, and the results of many costly and important tests and experiments.

This work of reference supplies such practical and useful information as the important mechanical laws, rules, and principles; physical properties and compositions of standard and special metals used in machine construction and other engineering structures; characteristic features and functions of machine tools and other manufacturing equipment, and many other subjects. Price, $8.00 set.

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

Ingenious Mechanisms for Designers and Inventors

Two Books that Form a Complete Course of Study



To own these two volumes, that form a complete course of study, is to have a comprehensive encyclopedia of mechanical movements unparalleled in scope and usefulness. Each volume is an entirely independent treatise on mechanisms; both books are similar in size and general character, but the contents are different.

Every mechanism described and illustrated embodies some idea or principle likely to prove useful to designers or inventors. Volume I contains 536 pages and 300 illustrations; Volume II, 538 pages and 303 illustrations. Price, $8 set or $5 for either book separately.

THE INDUSTRIAL PRESS, 148 Lafayette Street, New York 13, N. Y.

area, and the Hudson River Valley. GILBERT L. COX, metallurgical and chemical engineer, will be in charge.

ED T. LANDGRAFF has been appointed a member of the sales staff of the Chiksan Co., Brea, Calif., manufacturer of ball-bearing swivel joints. He will be located at 50 Church St., New York 7, N. Y. In addition to serving the domestic market in the New York territory, Mr. Landgraff will be eastern representative of the Chiksan Export Co. ROY W. SEXTON will be associated with Mr. Landgraff in the New York office.

MOLDEX RUBBER & PLASTICS CORPORATION has been established at 1 E. 57th St., New York City, by LOUIS K. BRAUNSTON, formerly vice-president and general manager of the Miller Products Co. ARCHE A. MAYERS is vice-president of the new company, and GEORGE J. WILSON plastics engineer. Branch offices will be maintained in Akron, Kansas City, and Los Angeles. The company will supply molded and extruded rubber and plastic parts, gaskets and coated fabrics to manufacturers.

JOSEPH F. LIBSCH has become associated with Lepel High Frequency Laboratories, Inc., 39 W. 60th St., New York 23, N. Y., in the capacity of consulting metallurgist. Dr. Libsch is a member of the faculty of the metallurgical engineering department at Lehigh University, Bethlehem, Pa. His services will be available to manufacturers in solving problems pertaining to induction heating.

PUTNAM TOOL CO., Detroit, Mich., announces the appointment of SAMUEL D. CONANT as district sales representative for upper New York State. His headquarters will be at 603 Claybourne Road, Rochester 7, N. Y. Mr. Conant was previously Detroit district sales manager for the Greenfield Tap & Die Corporation.

F. J. GAFFNEY, formerly head of the measurement and test equipment group of the M.I.T. Radiation Laboratory, has been appointed chief engineer of the newly organized Polytechnic Research & Development Co., Inc., 66 Court St., Brooklyn, N. Y., which is affiliated with the Polytechnic Institute of Brooklyn.

E. A. WATSON, until recently production manager at the Buffalo, N. Y., plant of the American Car & Foundry Co., 30 Church St., New York 8, N. Y., has been made assistant engineer in the Improvement Division of the company. His headquarters will be in New York.

W. D. LIGON has been made works manager of the new Buffalo plant of the Westinghouse Electric Corporation's Motor Division, into which the Division has been moved from East Pittsburgh. He was formerly manager of manufacturing in the Motor Division.

HARRY W. FINK has been appointed resident manager for the New York branch office at 1775 Broadway, New York 19, N. Y., of the LaSalle Engineering Co., whose headquarters are in Chicago, Ill.

NELSON M. HOPKINS, who recently resigned as purchasing agent for machinery at the Curtiss-Wright plant in Buffalo, N. Y., has become sales manager for the Kane & Roach Co., Syracuse, N. Y.

HAROLD C. R. CARLSON has been appointed chief engineer of the Chas. Fischer Spring Co., 749 Atlantic Ave., Brooklyn 17, N. Y.

Ohio

F. R. MACFADYEN has been transferred from the Milwaukee office of the Timken Roller Bearing Co. to the engineering department at Canton, Ohio, where he will serve as industrial engineer. WALTER F. GREEN has been promoted to the position of assistant manager of the company's Division of Research and Development, and JOSEPH M. ROSHONG has been named superintendent of the Division. HARLEY J. URBACH has been appointed works engineer, filling the post formerly held by Mr. Green.

ROBERT N. HARWOOD has resigned as assistant manager of the Cleveland plant of Edgar T. Ward's Sons Co. to join the Ohio Stainless & Commercial Steel Co., 2966 E. 55th St., Cleveland 4, Ohio, as general manager. The Ohio Stainless & Commercial Steel Co. has established a new warehouse at the 55th St. address, which handles stainless steels, hot- and cold-rolled alloy steels, cold-rolled carbon bars, and tool steels.

HENRY A. STIX, treasurer of the Federal Machine & Welder Co., Warren, Ohio, and its subsidiaries Warren City Mfg. Co. and Sommer & Adams, has been elected executive vice-president of Federal operation. The title of general manager has been abolished, and the responsibilities of general management have been assigned to the executive vice-president.

Henry A. Stix, Executive Vice-president of Federal Machine & Welder Co.

LINCOLN ELECTRIC CO., Cleveland, Ohio, announced the addition of the following representatives to its district field office staffs: JOHN F. MCFEETERS has joined the Kansas City, Mo., office; HUBERT G. HINKLE has been assigned to the Columbus, Ohio, area; K. S. LAMB has been appointed welding engineer in the New York territory; and THOMAS W. DAY has been named welding engineer at the St. Louis, Mo., office.

WALTER PESTRAK has been appointed representative of the Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich., in its new southeastern Ohio and western Pennsylvania sales district. Mr. Pestrak has been associated with the Duer Engineering Co. as field sales engineer in this area for the Progressive Welder Co. during the last few years. His headquarters will be at Canton, Ohio.

PAUL ABEL has been appointed chief engineer of the Yoder Co., Cleveland 2, Ohio, manufacturer of special metalworking machinery, succeeding G. E. KENTIS, who has resigned. Mr. Abel started with the company in 1934 as assistant chief engineer. During the war he had charge of gun and shell production for the company.

CHARLES E. BUNTING was elected chairman of the board of directors of the Bunting Brass & Bronze Co., Toledo, Ohio, at the recent annual meeting. GEORGE H. ADAMS, formerly executive vice-president, was elected president, succeeding Mr. Bunting. WALTER F. VOLK was elected secretary and treasurer.

J. A. WAGNER has been elected vice-president and manager of the Sommer & Adams Co., Cleveland, Ohio, a subsidiary of the Federal Machine & Welder Co. He was formerly vice-president of engineering and sales of the Advance Tool & Die Co., Detroit, Mich.

WARREN CITY MFG. CO., a subsidiary of the FEDERAL MACHINE & WELDER CO., will begin the construction of a seven-million dollar plant at Warren, Ohio, within the next sixty days for the full-scale production of a new line of all-steel welded presses and press brakes.

GEORGE W. STAMM has been appointed assistant branch manager of the Crucible Steel Co. of America at 1258-74 E. 55th St., Cleveland, Ohio. He was previously a service engineer with the Tool Steel Division at Syracuse, N. Y.

CHARLES GROSS has been appointed vice-president in charge of sales of Aeronautical Products, Inc., Washington Court House, Ohio. EDWARD JONKE has been made assistant to the president.

AMERICAN GAUGE Co., 125 Bayard St., Dayton 1, Ohio, announces that the name of the concern has been changed to AMERICAN GAGE & MFG. Co. No change has been made in the location of the company or in the personnel.

CHARLES U. S. GRANT has been appointed sales engineer at the Cleveland office of Foote Bros. Gear & Machine Corporation.

R. J. SWING has been appointed general sales manager of the Bunell Machine & Tool Co., Cleveland, Ohio.

Pennsylvania

BROWN INSTRUMENT Co., Philadelphia, Pa., DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR Co., has opened a sales and service office at 16 State St., Rochester, N. Y., under the supervision of GERALD L. BRITTON. O. J. RICHARDSON has been appointed industrial manager of the Brown Instrument Co.'s office at Detroit, Mich., and GEORGE W. BROWN industrial manager of the Cincinnati office.

KEYSTONE ABRASIVE WHEEL, INC., Carnegie, Pa., has completed the rebuilding of its plant, which was destroyed by fire last October, and operations have been resumed. The new sales and production personnel includes F. E. OPPLER, vice-president in charge of sales, and D. B. FISHER, vice-president in charge of manufacturing.

DR. GUILLIAM H. CLAMER, president of the Ajax Metal Co., Philadelphia, Pa., will deliver the fourth annual A. F. A. Foundation Lecture before the fiftieth anniversary convention of the Association, to be held in Cleveland May 6 to 10. The lecture will constitute a report on extended research on test bars and test bar practice.

CARPENTER STEEL Co., Reading, Pa., has announced plans for the construction of a modern research laboratory to provide the latest and most complete facilities for developing new and improved steels and for maintaining exact control over high-quality tool, stainless, and alloy steels.

ROLAND C. DISNEY has been appointed manager of the eastern district of the Baldwin Locomotive Works, Philadelphia 42, Pa. Mr. Disney was recently discharged from the Army with the rank of Lieutenant-Colonel. His offices will be in the Broad St. Station Building in Philadelphia.

READING DIVISION OF ATLANTIC PLASTICS, INC., Ganster Bldg., Reading, Pa., announces that it will operate in the future under the name of the POLYMER CORPORATION, and will be an affiliate organization instead of a division of Atlantic Plastics, Inc., Flushing, L. I., injection molders.

GEORGE W. FRICK has been designated executive vice-president of the Carbide Die & Mold Co., Pittsburgh, Pa., and will be in direct charge of the company's sales. Mr. Frick was previously general sales manager of the Firth-Sterling Steel Co.

R. S. STOVER has been appointed supervisor of the Philadelphia-Washington district of Ampco Metal, Inc., with headquarters at the Wilford Building, Philadelphia, Pa. He was previously district manager at the Washington, D. C., office.

HARRY WILSON, JR., has been elected first vice-president of the Jessop Steel Co., Washington, Pa. Mr. Wilson has been associated with the company for the last forty years in various capacities.

RALPH H. LIGHTNER has been named general sales manager of the Titan Metal Mfg. Co., Bellefonte, Pa., succeeding J. B. CRAIG, vice-president, who has been appointed controller.

Wisconsin

J. R. G. HARRIS has been made manager of resistance welding sales of Ampco Metal, Inc., 1745 S. 38th St., Milwaukee 4, Wis. D. S. GOEBEL has been appointed manager of mill products sales, and G. E. MCCULLOCH manager of safety tool sales. F. C. HAWKS has joined the sales staff as field engineer for mill products, and will make his headquarters in Chicago.

MICHIGAN TOOL Co., Detroit, Mich., manufacturer of gear production equipment and tools, has opened a branch office in Milwaukee, Wis., at 739 North Broadway. C. B. PARSONS, formerly superintendent of the Dayton Tool & Engineering Co., will have charge of the new office.

* * *

Industrial Workers Will Pay Large Part of Increased Automobile Shop Wages

A nation-wide survey indicates that seven out of every ten industrial workers travel to their jobs by automobile. When the automobile workers demand increased pay out of proportion to the pay received in other industries, they merely raise the price of automobiles for themselves and their fellow workers throughout the nation. In the past, the automobile industry has been able to give everyone more car for the money throughout the years, and at the same time has paid the highest wage rates of any large industry in the country. Present developments in wage demands in automobile plants are, however, likely to upset this traditional trend toward better cars for less money for some time to come. The cars may be better, but they cannot be sold for less money if the manufacturing cost is unduly raised by arbitrary methods.

Coming Events

MAY 6-10—GOLDEN JUBILEE CONVENTION AND EXHIBIT of the American Foundrymen's Association in the Public Auditorium at Cleveland, Ohio. Secretary, William W. Maloney, 222 W. Adams St., Chicago 6, Ill.

MAY 7-9—Annual convention and corrosion exhibition of the NATIONAL ASSOCIATION OF CORROSION ENGINEERS, at the Municipal Auditorium in Kansas City, Mo.; headquarters, Hotel President. Executive secretary, Elton Sterrett, 318 Southern Standard Bldg., 711 Main St., Houston 2, Tex.

JUNE 2-7 — Summer meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at French Lick Springs Hotel, French Lick Springs, Ind. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York 18, N. Y.

JUNE 3-6—Aviation Division Meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Los Angeles, Calif. Clarence E. Davies, secretary, 29 W. 39th St., New York 18, N. Y.

JUNE 12-15—Oil and Gas Power meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Milwaukee, Wis. Clarence E. Davies, secretary, 29 W. 39th St., New York 18, N. Y.

JUNE 17-20 — Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Detroit, Mich. Clarence E. Davies, secretary, 29 W. 39th St., New York 18, N. Y.

JUNE 20-22 — Conference of the NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION at Atlantic City. W. Lane Witt, president and general manager, 100 E. Ohio St., Chicago 11, Ill.

JUNE 21-22—Applied Mechanics meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Buffalo, N. Y. Clarence E. Davies, secretary, 29 W. 39th St., New York 18, N. Y.

JUNE 24-26—Spring meeting of the SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS at the Hotel Statler, Buffalo, N. Y., including a symposium on the fatigue of manufactured parts, under joint sponsorship with the American Society for Testing Materials. Secretary-treasurer, W. M. Murray, Central Square Station, Cambridge 39, Mass.

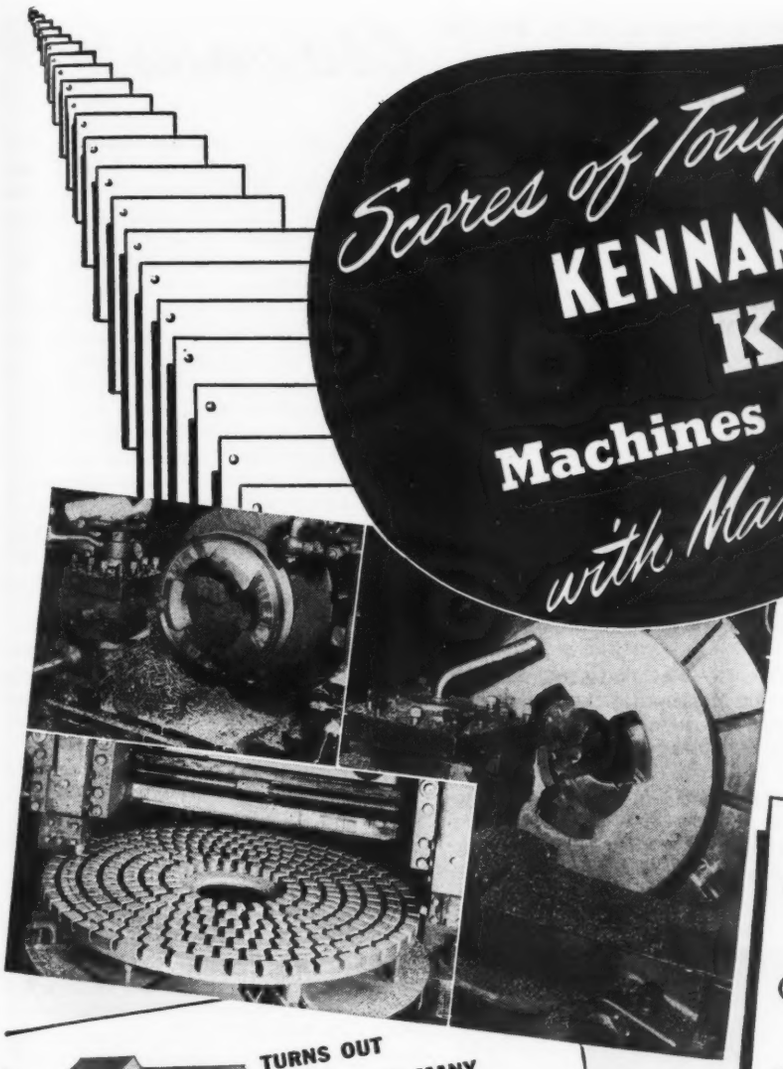
JUNE 24-28—Forty-ninth annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Hotel Statler, Buffalo, N. Y., in conjunction with the seventh exhibit of testing apparatus and related equipment. C. L. Warwick, executive secretary, 260 S. Broad St., Philadelphia 2, Pa.

AUGUST 22-24 — National West Coast Transportation and Maintenance Meet-

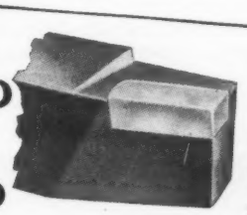
Scores of Tough Jobs Prove

KENNAMETAL K6 Machines CAST IRON

with Maximum Economy

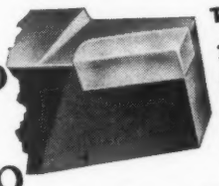


Kennametal Grade K6 is one of the most useful and needed recent developments in tool materials for machining cast iron and non-ferrous metals. It is an improved tungsten carbide having unusual strength in combination with exceptional abrasion-resistance and high hardness. The four performance studies outlined below are typical of scores of comparative service results that clearly show the superior properties of K6 for interrupted and continuous cutting on cast iron.



REMOVES TONS OF METAL FROM CHILLED CAST IRON PARTS, AT TOOL COST OF 74¢ PER TON

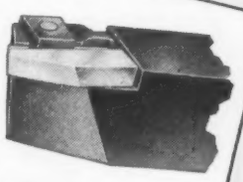
Style 12 Tool with K6 tip turns 1½ lineal miles between grinds! Other makes of carbide failed at all speeds and feeds. After 10 regrinds K6 tip is used on lighter jobs. Operation—turning cast iron piston trunks, 21½" diameter, having six 3" or 4" ports (interrupted cut). Chilled around port holes. Very sandy surface. Feed—.09375". Depth of cut —½". SFM-120.



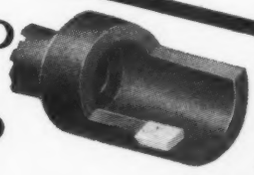
TURNS OUT 10 TIMES AS MANY PIECES, ON ROUGH CASTING, BETWEEN REGRINDS

One to four pieces between grinds was the best performance recorded by other carbides on machining a webbed flange of inferior grade cast iron, having hard spots, and sand pockets. K6 turns out more than 40! Operation—turning outside diameter and facing both sides of hub and rim. Feed —.032" Depth of cut 1/16" to 3/8" SFM-280.

MULTIPLIES OUTPUT, ON FACING OPERATION, ON SANDY IRON CASTING



Replacing another make of carbide with a Style 11HD Tool having a clamped-on, advanceable K6 tip, made possible tripling the feed, doubling the cutting speed, and facing 8 times as many pieces per regrind. Operation—facing sandy iron castings. Feed—.036". Depth of cut—⅛" to 3/16" SFM-150 at start, 320 after tool entered cut.



CUTS 35 PIECES (on Abrasive Electric Iron) AS AGAINST 3 FOR CARBIDE PREVIOUSLY USED

This unique tool, tipped with Kennametal K6, turns out 11½ times as much work between grinds as the carbide tool previously used. Operation—finish trepanning cut on electric iron part. Feed—.003". SFM-210. Accurate tolerances and good finish required, and produced.

The best way to prove that K6 makes possible better, faster machining on cast iron, at lower tool costs, is to try it in your own shop—then compare tool performance and overall costs. Order a few Kennametal blanks, or complete tools, now—and ask our district field engineer, who is fully acquainted with the properties of K6, to help you get maximum results from this *new* and *improved* tungsten carbide—Kennametal Grade K6.

KENNAMETAL

SUPERIOR CEMENTED CARBIDES

TRADE MARK REG. U. S. PAT. OFF.

KENNAMETAL *Inc.*, LATROBE, PA.

ing of the SOCIETY OF AUTOMOTIVE ENGINEERS at the New Washington Hotel, Seattle, Wash. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

SEPTEMBER 11-12 — National Tractor Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Schroeder, Milwaukee, Wis. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

SEPTEMBER 16-20 — 1946 Exhibit and conference of the INSTRUMENT SOCIETY OF AMERICA at the William Penn Hotel in Pittsburgh, Pa. Richard Rimbach, executive secretary, 1117 Wolfendale St., Pittsburgh 12, Pa.

SEPTEMBER 18-19—Fall meeting of the AMERICAN MACHINE TOOL DISTRIBUTORS' ASSOCIATION at the Homestead, Hot Springs, Va. Executive secretary, Thomas A. Fernley, Jr., 505 Arch St., Philadelphia 6, Pa.

SEPTEMBER 30-OCTOBER 3—Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Boston, Mass. Clarence E. Davies, secretary, 29 W. 39th St., New York 18, N. Y.

OCTOBER 3-5 — Aeronautic meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Biltmore Hotel, Los Angeles, Calif. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York 18, N. Y.

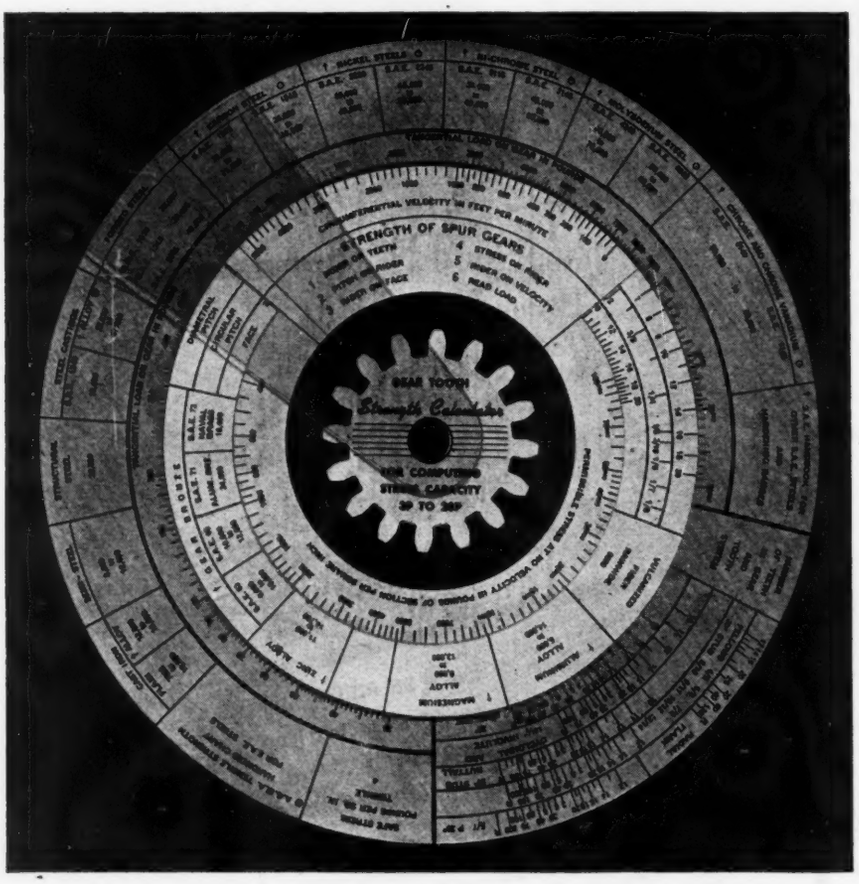
OCTOBER 16-17 — National Transportation and Maintenance Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Knickerbocker, Chicago, Ill. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

NOVEMBER 7-8—National Fuels and Lubricants Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Mayo Hotel, Tulsa, Okla. Secretary and general manager, John A. C Warner, 29 W. 39th St., New York 18, N. Y.

NOVEMBER 17-22 — Annual meeting of the AMERICAN WELDING SOCIETY at Atlantic City, N. J., in conjunction with the National Metal Congress and Exposition. For further information, address American Welding Society, 33 W. 39th St., New York 18, N. Y.

DECEMBER 2-4—National Air Transport Engineering Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Edgewater Beach Hotel, Chicago, Ill.

DECEMBER 2-6—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in New York City. Clarence E. Davies, secretary, 29 W. 39th St., New York 18, N. Y.



Gear-tooth Strength Calculator, Distributed by Barber-Colman Co., for Computing the Stress Capacity of Gears from 3 to 28 Pitch

Obituaries

N. C. HILTON, executive manager of the abrasive wheel, diamond wheel, and bowling ball departments of Raybestos-Manhattan, Inc., Manhattan Rubber Division, Passaic, N. J., died on March 14, in Glen Ridge, N. J. Mr. Hilton was born near Elmira, N. Y., and was educated in the public schools of that city. He joined the Manhattan Rubber organization in Passaic on November 22, 1915, and had been connected with the company continuously since that time. Under his management, the abrasion wheel department expanded considerably and an abrasive wheel laboratory was added. When the importation of natural abrasives was curtailed during World War I, the technicians in this department developed artificial abrasives that proved highly satisfactory.

LEE A. DAINES, vice-president and general sales manager of the Heppenstall Co., Pittsburgh, Pa., died suddenly on March 29, in Miami, Fla. Mr. Daines was born in Jackson, Mich., on January 28, 1894. He attended Albion College and the University of Michigan. In 1923, he joined the Heppenstall Co. and was assigned to the Detroit office. A few years later he was transferred to the company's Chicago office, where he served as district manager until almost a year ago. On May 1, 1945, Mr. Daines was elected to the position he held at the time of his death. He had been a director of the company for eight years. During World War I, Mr. Daines served in the Air Force. He is survived by his widow, a son, and a daughter.

PAUL BARNHARDT, secretary, treasurer, and director of the Riverside Metal Co., Riverside, N. J., died on April 8.

* * *

Gear-Tooth Strength Calculator

A gear-tooth strength calculator, for convenience in determining gear-tooth specifications, is being distributed to design engineers without obligation by the Barber-Colman Co., Department 13, Rockford, Ill., manufacturer of gear hobs and hobbing equipment. This calculator can be used for computing stress capacity of gears from 3 to 28 pitch. It also indicates the permissible stress values for various kinds of material, from which the tangential load capacity can be derived, as shown in the accompanying illustration.

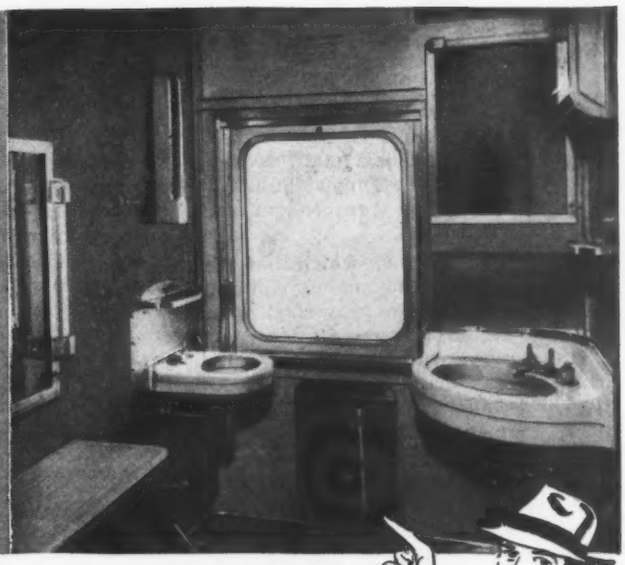
* * *

The shipbuilding activities of America reached such proportions during the war that, in 1943 and 1944, shipbuilding consumed over 21 per cent of all the steel produced in the United States.

INDEPENDENT INVESTIGATOR FINDS

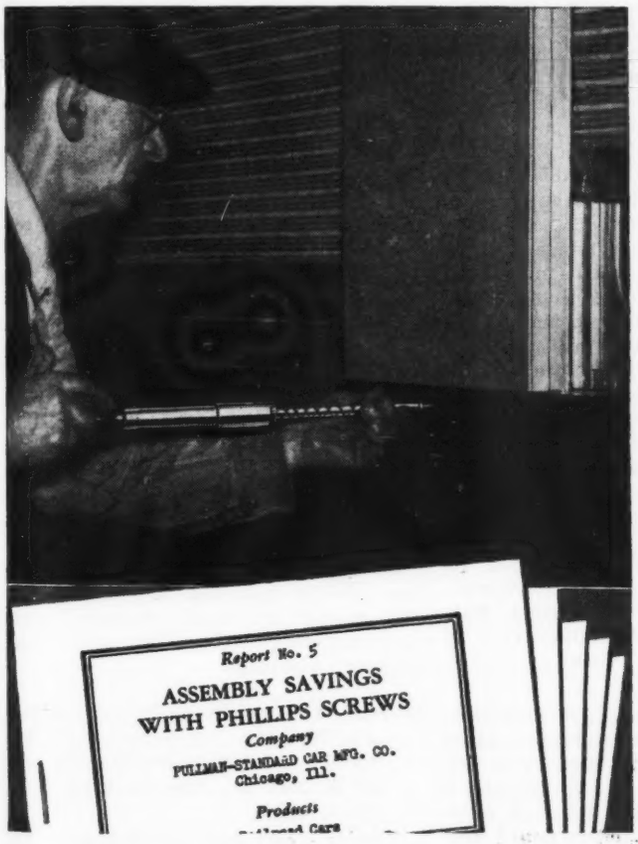
Phillips Screws pay Pullman

big money savings for hundreds of driver skids eliminated! Hold better . . . look better!



Investigators from James O. Peck Co., industrial research authorities, are visiting a number of representative plants to get authentic FACTS on assembly saving. Get the "INSIDE STORY" of successful assembly practice — read his fact-filled reports!

"When we used slotted screws, we had plenty of trouble with drivers slipping and puncturing the pressed wood panels we use by the thousand for inside trim," a Pullman assembly executive told the investigator. "This meant removing and discarding the panel, replacing and hand-painting – to the tune of several dollars per skid. Phillips Screws ended driver skids. But that's only one way they pay off.



"Where the heads show in the finish they look better. They don't have to be lined up, like slotted screws, which means they can be set up tighter to resist vibration.

"Railroads like them because they can't be loosened by passengers with coins or nail files like slotted screws – to tear clothes and cause damage claims."

REPORT TELLS MORE PHILLIPS ADVANTAGES

The investigator asked Pullman the same questions you would ask about assembly methods. The report tells you the complete, revealing answers.

It's one of a series of assembly studies covering all types of products – metal, plastics, wood – being made to show how the many Phillips Screw advantages add up big savings you can make in your assemblies.

The reports now ready – and more to come – comprise a practical manual of modern assembly methods – never-before-printed information – inside facts you'd pay good money to get – and you can have them, now, FREE!

PACKED WITH IDEAS FOR SAVINGS IN YOUR ASSEMBLIES

Find out how industry's top-flight assemblers licked problems like your own! Get these reports! Don't wait – fill out and mail the coupon TODAY!

PHILLIPS Recessed Head SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

American Screw Co.
Atlantic Screw Works
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Central Screw Co.
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Corbin Screw Div. of American Hdwe. Corp.
The H. M. Harper Co.
International Screw Co.
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26 SOURCES

Manufacturers Screw Products
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Sterling Bolt Co.
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PHILLIPS SCREW MFRS.,
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2300 Industrial Trust Bldg., Providence, R. I.

Please send me the reports on Assembly Savings with Phillips Screws

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Company.....

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.....

Books and Publications

THOMAS' REGISTER OF AMERICAN MANUFACTURERS (1946). In three volumes, with separate index, total 7000 pages. Published by the Thomas Publishing Co., 461 Eighth Ave., New York 1, N. Y. Price, $15.

This buying guide, which has well been called a "purchasing encyclopedia," now in its 1946 edition, covers all manufactured products in the United States. The directory, originally brought out in one volume, has become so extensive that it is now published in three volumes with an additional index volume. Volumes I and II, covering about 5900 pages, are devoted exclusively to listings of all manufacturers, classified by products. Volume III, about 900 pages, gives an alphabetical list of manufacturers, with branches, subsidiaries, and other data, and also contains an alphabetical section on trade names, together with export and other miscellaneous information. The index volume, or finding list, is a separate volume, of about 200 pages, which facilitates locating the information desired in Volumes I, II, and III. This arrangement was made in accordance with a vote taken among the majority of the subscribers who responded to an inquiry as to their preference.

In Volumes I and II, giving the names of manufacturers classified by products, industrial products of every kind are listed, 70,000 in all being covered. These are classified not only by generalized group names, but by specific types, so that the prospective buyer can easily find the particular kind of product that will meet his requirements. The names of the manufacturers under each product classification are arranged by states and cities, which is an added advantage.

The three large volumes are bound in cloth, while the index is provided with a substantial cardboard cover. The directory is now in its thirty-fifth year. It is generally recognized as of unusual value to purchasing departments and buyers, as well as to sales executives who require a list of products or names of manufacturers for various purposes. Thorough indexing and cross-indexing make the finding of specific items convenient.

TIME STUDY AND MOTION ECONOMY. By Robert Lee Morrow. 338 pages, 6 by 9 inches. Published by the Ronald Press Co., 15 E. 26th St., New York 10, N. Y. Price, $5.

This book explains both the fundamentals and the advanced techniques of time study and motion economy, and shows how motion economies, better methods, and the application of time studies will eliminate unnecessary manufacturing costs and make possible the better control of essential costs. It contains twenty-three chapters dealing with the following subjects: Human Problems of Methods Change; Operation Analysis; Flow Process Charts and Diagrams; Right- and Left-Hand Process Charts; How to Do More Work with Less Effort; Suggestion Plans; Analysis Techniques; Fundamentals and Uses of Time Study; Time-Recording Equipment; Time-Study Procedure; Terms Used in Time Study; Leveling and Rating; Synthetic Leveling; Fatigue in Industry; The Interruption Study; The Ratio-Delay Study; Final Computations; The Standard Data Method; Organizing and Training Time-Study Personnel; How to Secure Employe, Union, and Management Cooperation; Straight-Line Production; Automatic Machine Studies and Work Assignments; Feeds and Speeds for the Cutting of Metals.

PLASTICS MOLD ENGINEERING. By J. H. DuBois and W. I. Pribble. 494 pages, 5½ by 8½ inches. Published by the American Technical Society, Drexel Ave. at 58th St., Chicago 37, Ill. Price, $7.

Progress in the molding of plastics is dependent on the design and construction of molds. In the past, many toolmakers have considered their mold-making practice a trade secret, and little has been published on the subject. To meet this lack of information, the present book describing the design of the important types of molds and indicating their use has been brought out. Construction methods commonly employed are explained, since best results are obtained when molds are designed for tool-room equipment that is generally available, but many little used molding methods are also described, in order to stimulate interest and original study. Raw materials and product design are discussed at length. Procedures and calculations are given for the design of compression molds, transfer molds, injection molds, cold molds, and extrusion dies.

SIMPLIFIED PUNCH- AND DIE-MAKING. By James Walker and Carl C. Taylor. 235 pages, 5½ by 8½ inches. Published by the Macmillan Co., 60 Fifth Ave., New York 11, N. Y. Price, $5.

Each step in the design, construction, and operation of dies and punches is clearly explained in this book. The subject matter is such as to provide a comprehensive reference for tool engineers and others engaged in punch and die work, as well as a complete text for those learning punch- and die-making. All the important types of dies and punches in use today are covered, and detailed information on specifications, materials, methods of construction, and uses is included.

RELAY ENGINEERING. By Charles A. Packard. 640 pages, 4¼ by 6½ inches. Published by Struthers-Dunn, Inc., Philadelphia 7, Pa. Price, $3.

This little handbook, prepared by a manufacturer of electrical controls and relays, is intended to assist engineers who have relay problems, and presents data that will provide the answers to the tens of thousands of questions that have been asked by relay users over the last twenty-five years, based on the experience of the company in manufacturing relays. The equipment and circuits ordinarily encountered in the application of relays are explained in clear, simple language. One section of the book is devoted to servicing and inspection. A number of short-cuts, such as reading temperature rise directly from a slide-rule, are published here for the first time.

MACHINE TOOL WORK. By W. P. Turner; revised by H. F. Owen. 364 pages, 5 1/4 by 8 1/2 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $3.

This is the second edition of a book covering fundamental principles of machine tool work, including problems involving the lathe, planer, shaper, milling machine, drilling machine, and grinding machine. The text has been revised to bring it up to date. New chapters on shop safety and on broaching have been added, and new material has been included in the chapter on grinding. Problems have been gathered together at the back of the book for the sake of convenience.

FINE-GRINDING AND LAPPING. 74 pages, 5 1/2 by 8 1/2 inches. Published by the Machinery Publishing Co., Ltd., 17 Marine Parade, Brighton 1, England. Price, 3/6d.

The fundamental principles involved in fine finishing by grinding and lapping are reviewed in this book, and methods of performing these operations are described. The text comprises a reprint of a series of articles "How to Secure Fine Surfaces by Grinding," previously published in MACHINERY (London). It covers such subjects as selecting the right grinding wheel and getting the best results from the wheel; methods of dressing and truing wheels; balancing grinding wheels; coolants; and lapping operations.

INSPECTION HANDBOOK FOR MANUAL METAL-ARC WELDING. 156 pages. Published by the American Welding Society, 33 W. 39th St., New York 18, N. Y. Price, $1.50.

This is a complete authoritative manual on welding inspection. It covers the requirements and duties of a welding inspector; methods of testing welds; principal types of weld defects and how they can be corrected; and weld inspection by visual, magnetic-particle, and radiographic methods.

RECOMMENDED PRACTICES FOR RESISTANCE WELDING. 47 pages. Published by the American Welding Society, 33 W. 39th St., New York 18, N. Y. Price, 50 cents.

Here's Why

This Precision Job Was Tooled ON A GORTON SUPER-SPEED VERTICAL MILL

MANUFACTURER'S TEST PROVED THAT THE GORTON WOULD MACHINE THE BORING BARS WITH THE GREATEST ACCURACY, SPEED, RELIABILITY AND EFFICIENCY

Four operations were required to machine the tool hole in the boring bar shown above. They included counterboring, drilling, reaming and milling. To determine what mill would maintain the specified accuracies and complete the job in the least amount of time, test runs were made on a number of units.

Of the mills included in the test, a Gorton 8½-D Vertical Mill was selected as the machine to perform the operation because it proved the most highly efficient from every point-of-view . . . accuracy, speed, finish, ease of operation.

In this manufacturer's own words, the factors responsible for the superiority of the Gorton are "The Gorton is more solidly and accurately built than competitive machines designed for similar work."

HOW TO PRE-DETERMINE GORTON PERFORMANCE ON YOUR WORK

Gorton Super-Speed Millers are available in several models for a wide range of milling work. It is highly possible that the right model can produce equally outstanding results on jobs now being run in your plant. You can pre-determine Gorton results for yourself by using Gorton Engineering Service. Mail detail prints or work sample to Gorton at the address below. Tooling information and production estimates will be furnished promptly—no charge or obligation.

FREE For details on Gorton Super-Speed Vertical Mills as well as Duplicators and Pantographs, write today for Bulletin No. 1655.

JOB FACTS

NAME OF PART—Boring Bar with Micrometer Adjustment.

MATERIAL—Alloy Steel.

MACHINE—Gorton Vertical Milling Machine Model 8½-D.

FEED—Hand.

OPERATIONS—

1. Counterbore—$1\frac{1}{16}$"; 900 r.p.m.
2. Drill—$\frac{23}{64}$"; 1350 r.p.m.
3. Ream Drilled Hole—.369" and .375"; +.0005", −.0000"; 1350 r.p.m.
4. Milling Eccentric Groove $\frac{3}{8}$" dia. x $\frac{3}{32}$"; +.0000", −.0005"; offset: .093".

TIME—15 minutes, floor-to-floor time.

REMARKS—Completed on a production basis with high accuracy and finish.

GEORGE GORTON MACHINE CO.

1305 RACINE STREET, RACINE, WISCONSIN, U.S.A.

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Your Progress Depends Upon Your Knowledge of Your Industry

ONE MORE STRAW—ONE LESS CAMEL!

Many centuries ago the weight of one last straw broke a camel's back. Thus somebody's artless optimism about the strength of a vital part wrecked a perfectly good materials handling system.

Today it is plain, cold fact that ignoring the depressing effect of low temperatures on the impact strength of vital steel parts can be a short cut to a long line of avoidable, costly troubles.

The solution for the problem in the fable was less load or more camel. For the modern problem the answer is a molybdenum steel that combines the deep hardening and freedom from temper brittleness necessary to provide good low temperature impact strength.

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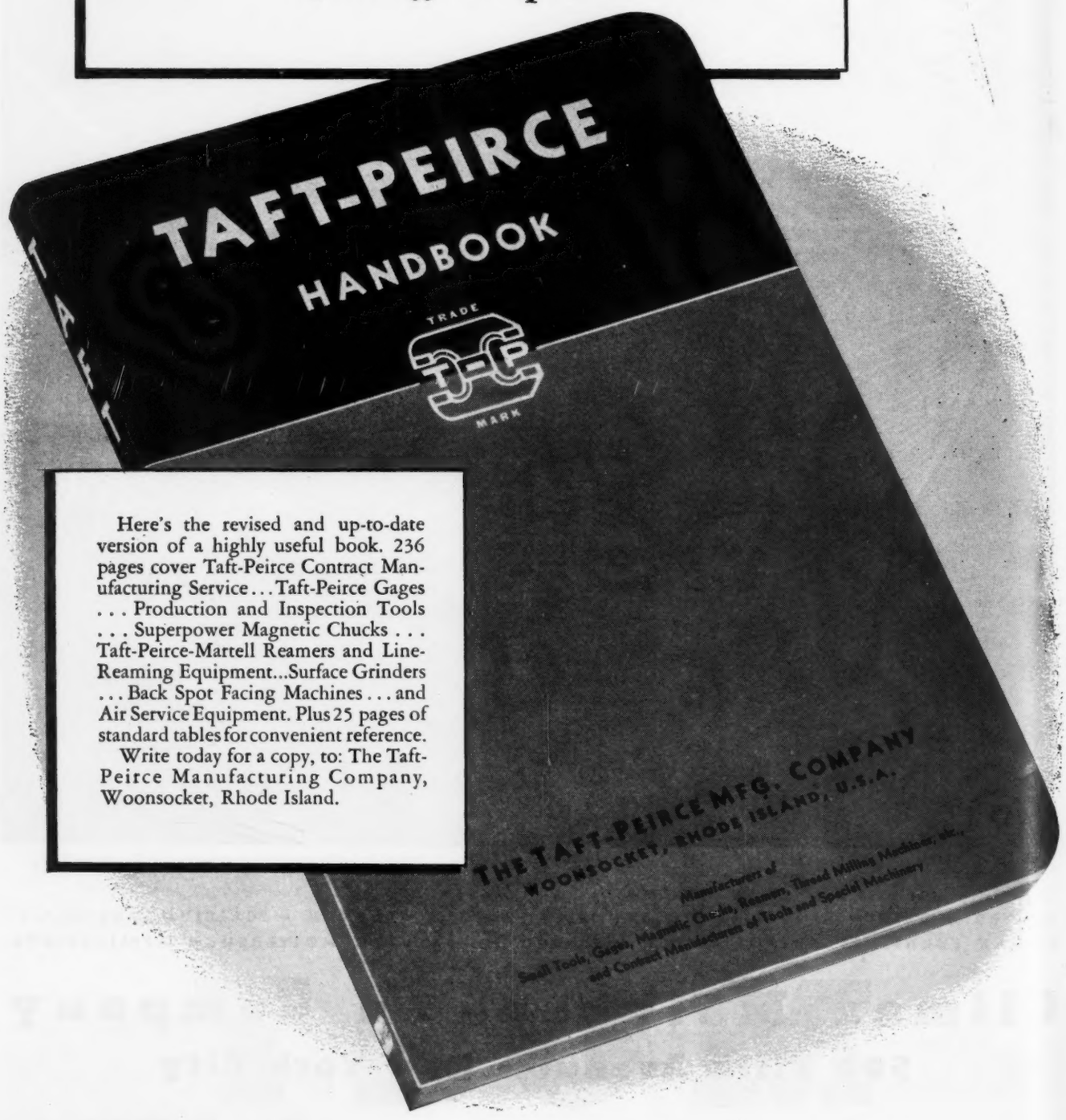

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Bunting

39

BRONZE BEARINGS ☆ BUSHINGS ☆ PRECISION BRONZE BARS

Where 500 pieces per grind is really *Something*

Conditions:

Depth of cut - - - - - - - - 3/32"

Feed per revolution - - - - - 0.016

Cutting speed - - 250 feet per minute

Turning, facing and chamfering a cast iron sleeve with Firthite sintered carbide tools on this job just meant about five times as many pieces per grind. Better production, less downtime, uniformly better products and a big reduction in grinding costs were the results.

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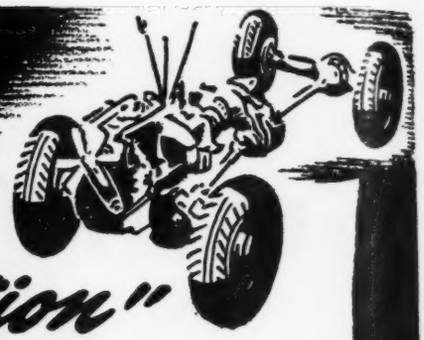
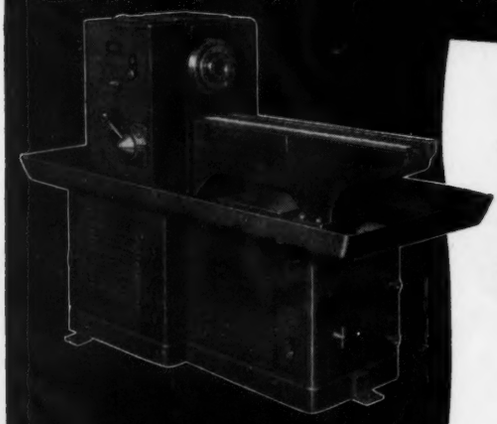


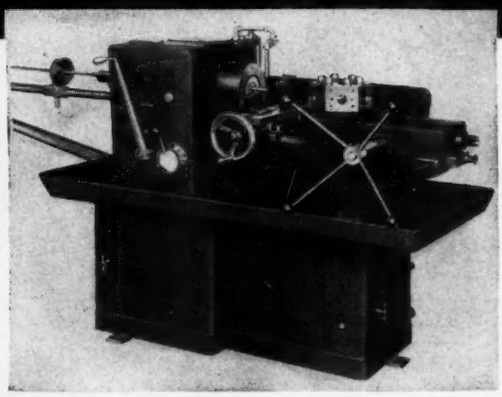


Above view shows the basic machine complete to the point of adapting it to YOUR specific requirements.

THE OSTER "Rapiduction"

Turning machine chassis is the starting Point for a wide DIVERSITY of Individual Applications

or, You can have it as a Complete Machine



Now, as formerly, the Oster No. 601 "RAPIDUCTION" machine can be furnished equipped with automatically indexed, 6-position turret (as illustrated at right) or with plain saddle and single tool post (as illustrated below).

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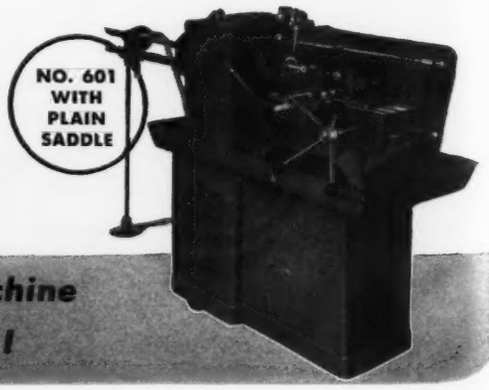

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Chief Engineer

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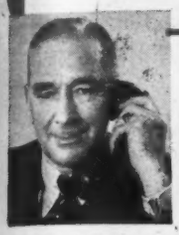

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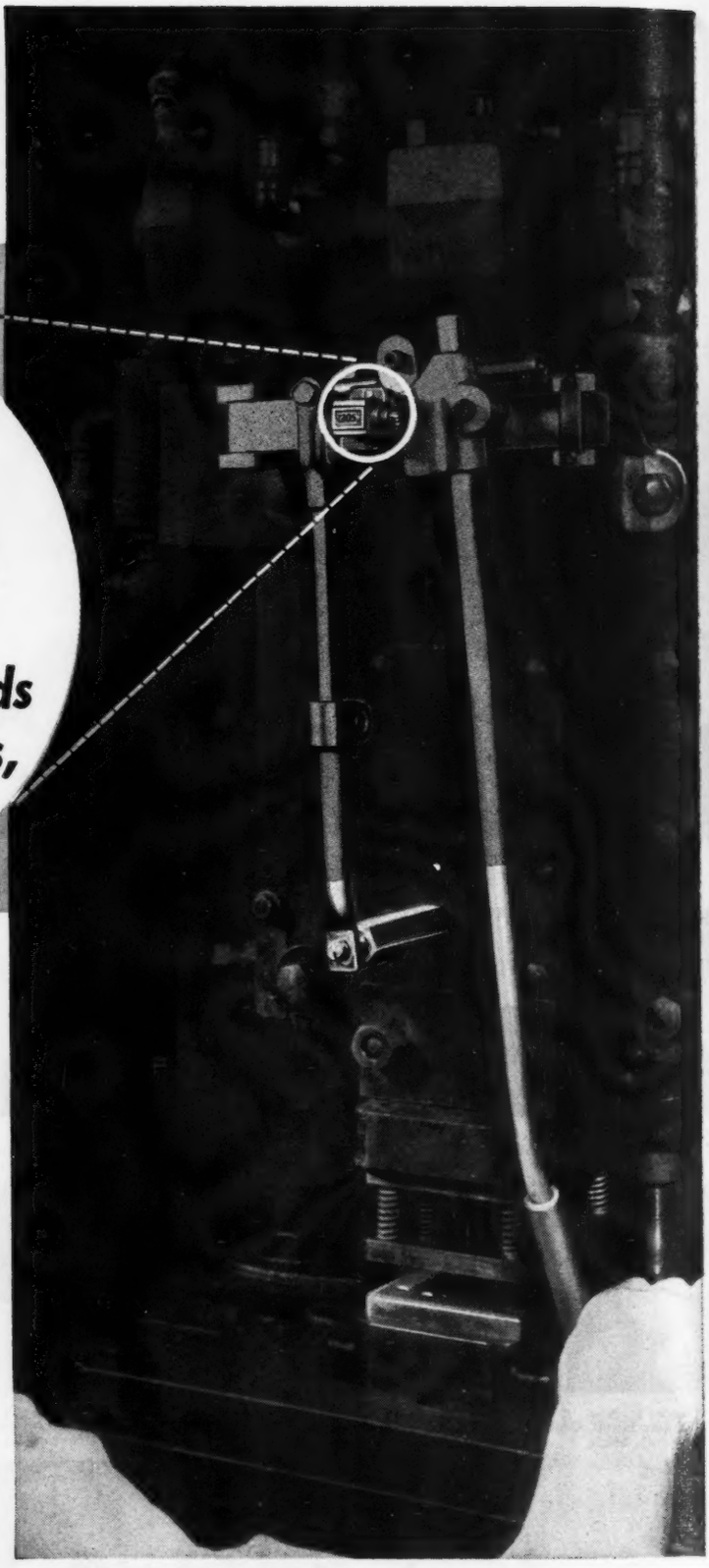

This double-duty guard moves operator's hands out of the danger zone on a punch press on each stroke . . . long before the dies close. And as the guard-arm operates, it registers the stroke on a Veeder-Root Counting Device . . . providing an accurate piecework record . . . but only if the guard mechanism is in place *and in use.* So it not only prevents lost-time from accidents . . . it also gives both employee and employer an accurate and up-to-the-minute record of die-stampings.

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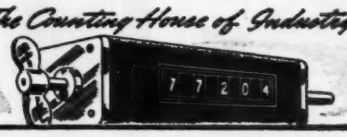

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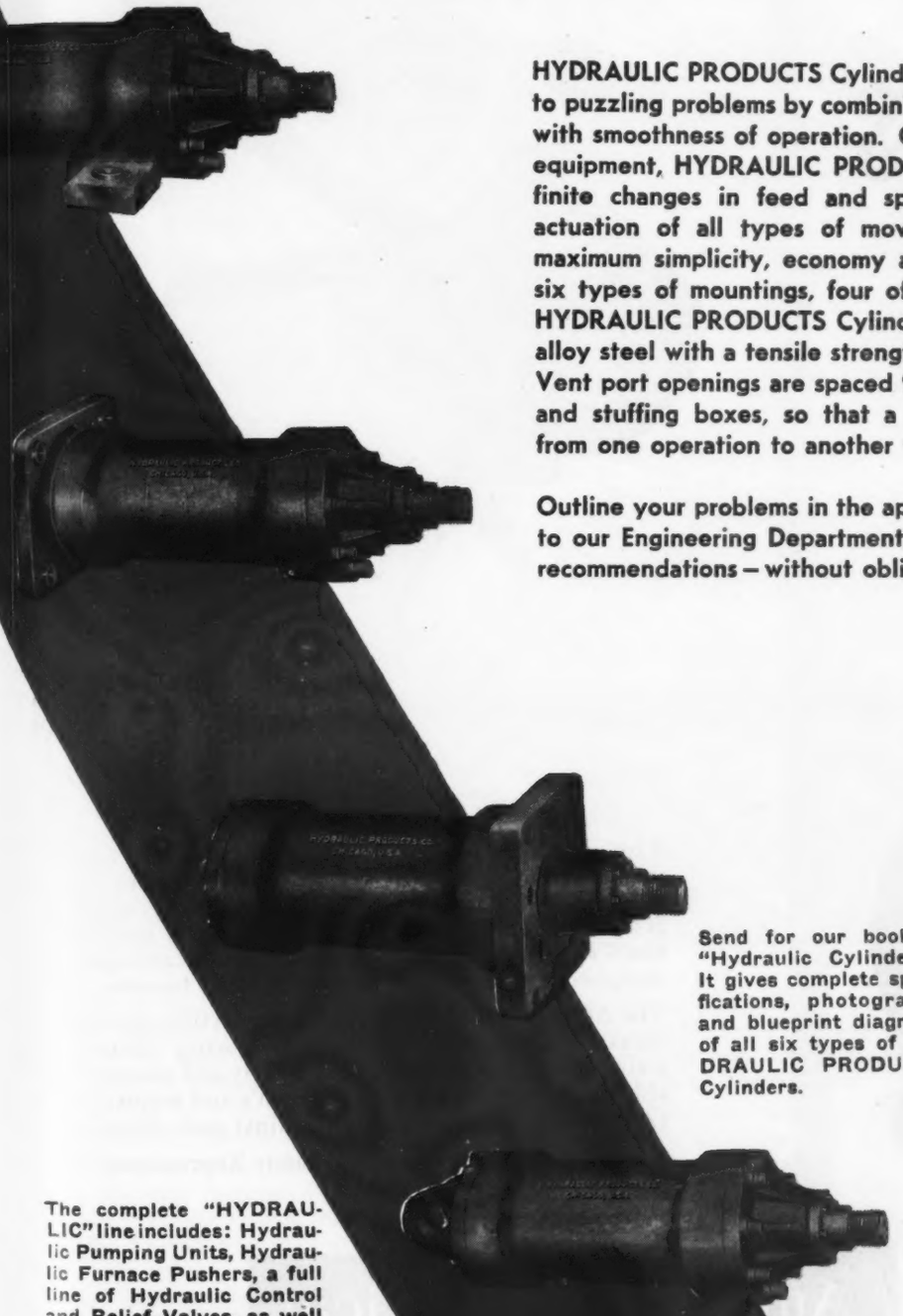

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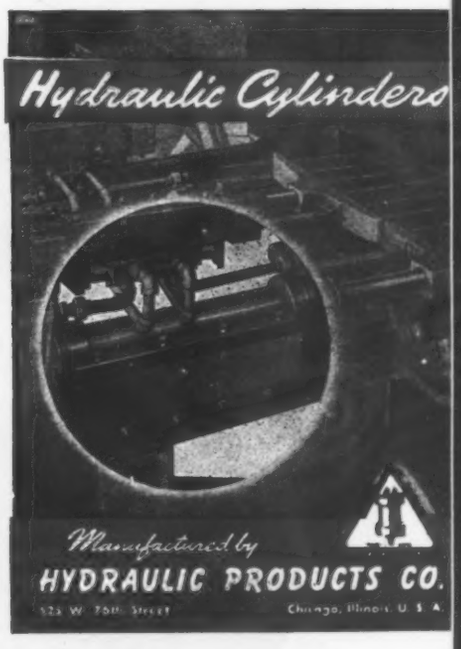
Outline your problems in the application of hydraulic power to our Engineering Department, and we will make specific recommendations – without obligation, of course.



Send for our booklet, "Hydraulic Cylinders". It gives complete specifications, photographs and blueprint diagrams of all six types of HYDRAULIC PRODUCTS Cylinders.

The complete "HYDRAULIC" line includes: Hydraulic Pumping Units, Hydraulic Furnace Pushers, a full line of Hydraulic Control and Relief Valves, as well as the Hydraulic Cylinders described above.

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FIT THE FACE

COMFORTABLY

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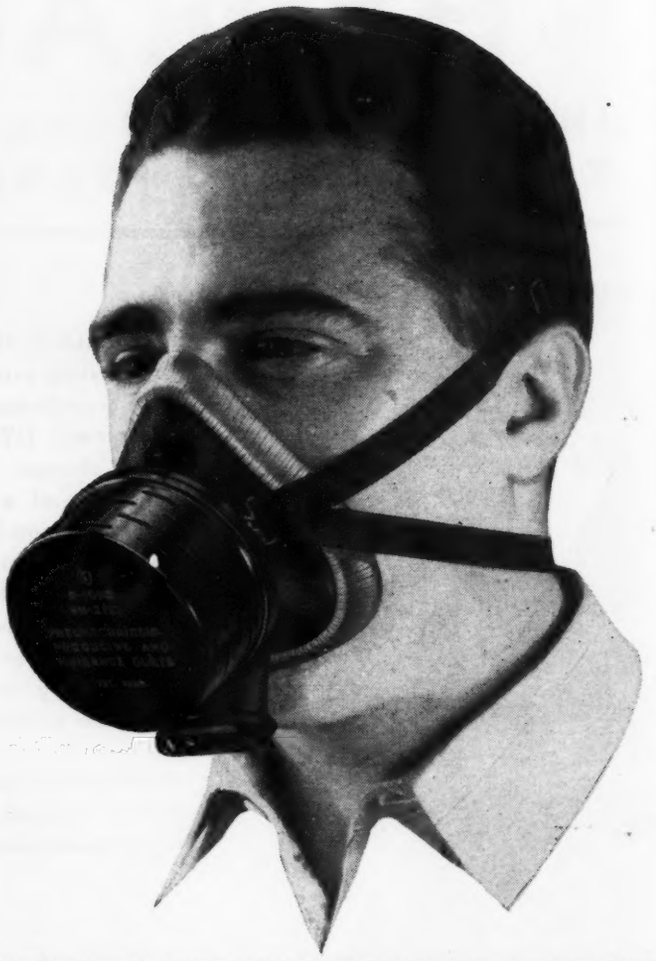
EXACTLY



The AO R-1000 Respirator establishes new standards of safety and comfort for workers requiring protection from dusts, gases and vapors. It is really seven respirators in one, as it may be fitted with any of seven interchangeable cartridges designed for protection against specific hazards.

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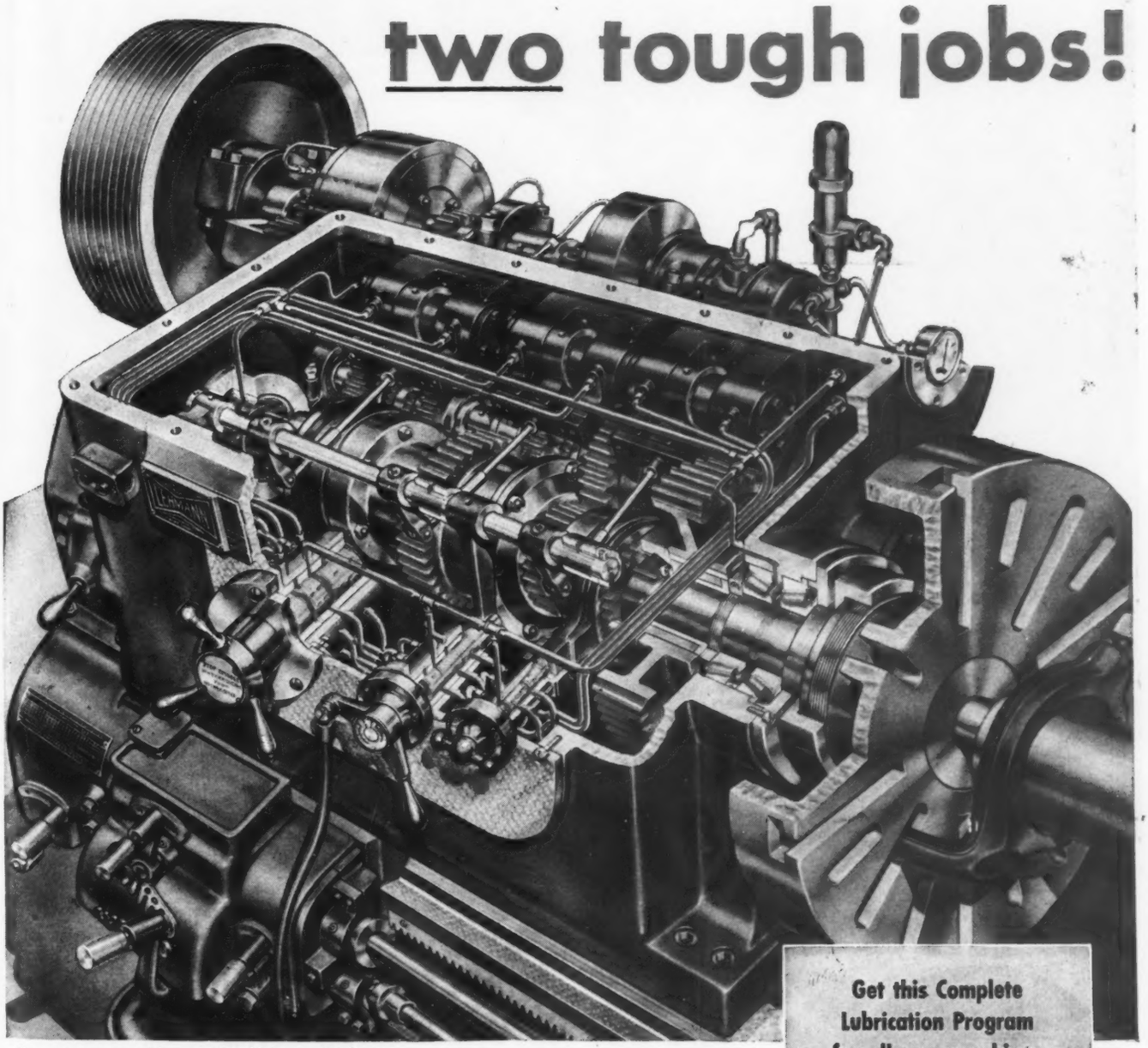
BRANCHES IN PRINCIPAL CITIES

Here one oil does two tough jobs!



Drawing prepared with cooperation of Lehmann Machine Co.

THIS ingenious variable-speed lathe poses a double problem for oil. For the same oil serves as both a hydraulic medium for the sensitive controls and as a lubricant for all headstock gears and bearings.

Both of these jobs require an oil with high chemical stability. Inside the hydraulic system, the oil must resist formation of deposits that clog lines, valves and clutch and brake mechanisms. On the gears and bearings it must fight off oxidation, due to continuous splashing and churning in the presence of air. Also, it must maintain strong films to minimize wear.

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LOOK! AN EJECTOR TYPE TOOL BIT WITH LONG SOLID CARBIDE INSERT!

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LESS FATIGUE! MORE POWER! LONGER LIFE!

You get all THREE

WITH

CLECO RIVETERS

Photo courtesy of The Clark Grave Vault Company, Columbus, Ohio, shows Cleco No. 60AO Riveter and Cleco Holder-on currently at work on locomotive syphons.

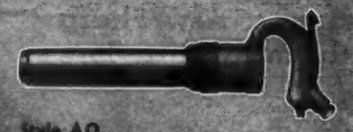
● First, Cleco Riveters are easier to operate because the tubular air-thrown valve insures smooth action, while vibration and recoil are reduced by the plunger cushion in the valve block. Note the 3 handle styles shown, all well fitted to the hand, and free of lugs, etc.

Secondly, you get more power, because in the large reservoir, surrounding the valve block, air is stored and pressure built up between blows. Thus air is impacted in volume on the piston at each stroke, greatly increasing the power of the blow.

Thirdly, Cleco Riveters are more durable! Handle is drop forged, heat treated for strength and resistance to fatigue stresses. Cylinder is of alloy steel, hardened and ground to perfect size and surface. Honing adds to the life of interior surfaces, insures lasting efficiency.

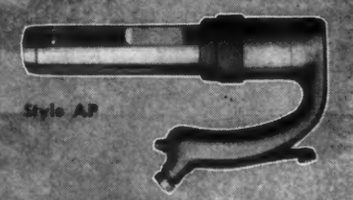
Ask for Bulletin 82 *that fully describes Cleco Riveters—both general industry models and aircraft types.*

3 CONVENIENT HANDLE STYLES



Style AO

Style AG



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For Best Results Use CLECO ACCESSORIES!

LINE STRAINER AND OILER traps trash and moisture, eliminates troubles due to insufficient lubrication.

VERIBEST AIR HOSE is extra tough, withstands rough treatment. Shown here with **BOWES COUPLINGS.**

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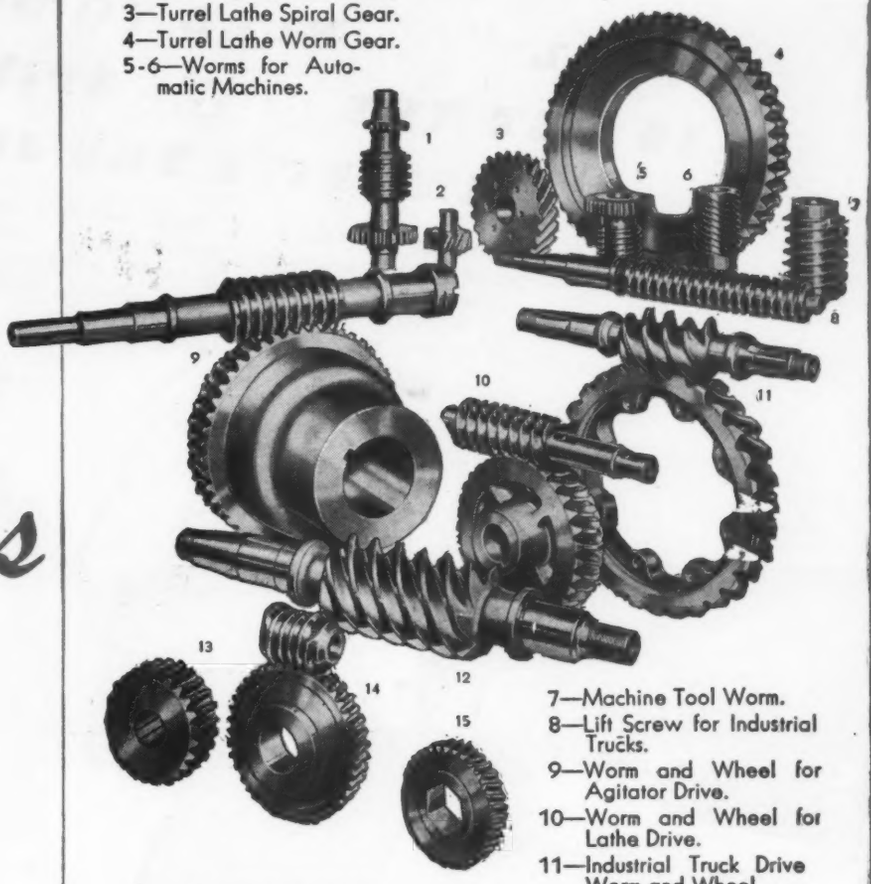
to meet all TESTS you want the BEST

in Gears



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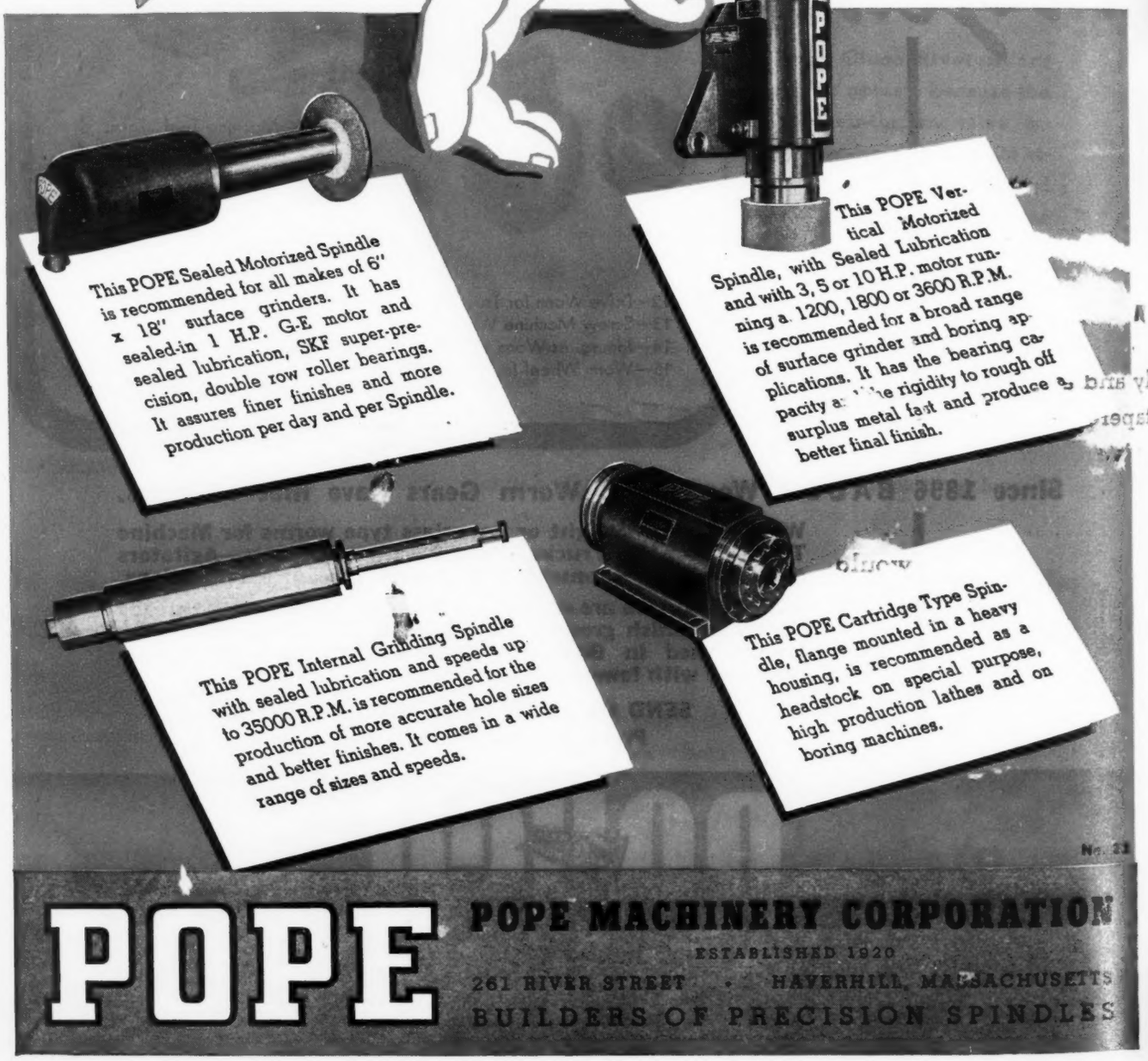
SPRINGFIELD 7, MASSACHUSETTS

ALL *You* NEED TO DO IS GET THE POPE SPINDLE THAT FITS THE JOB

Pope's large variety of types and sizes of Precision Spindles with Sealed Lubrication makes it a simple matter for you to get the right Spindle for your job. The four examples shown below give you some idea of the wide range available.

Simply send us a sketch with dimensions and the name of your machine, the method of holding the wheel or tool and the R.P.M. wanted. We will then submit recommendations with cost and delivery estimates.

These modern *"Package Units"* are complete, even to a sealed-in supply of lubricant good for the life of the bearings.



This POPE Sealed Motorized Spindle is recommended for all makes of 6" x 18" surface grinders. It has sealed-in 1 H.P. G-E motor and sealed lubrication, SKF super-precision, double row roller bearings. It assures finer finishes and more production per day and per Spindle.

This POPE Vertical Motorized Spindle, with Sealed Lubrication and with 3, 5 or 10 H.P. motor running at 1200, 1800 or 3600 R.P.M. is recommended for a broad range of surface grinder and boring applications. It has the bearing capacity and the rigidity to rough off surplus metal fast and produce a better final finish.

This POPE Internal Grinding Spindle with sealed lubrication and speeds up to 35000 R.P.M. is recommended for the production of more accurate hole sizes and better finishes. It comes in a wide range of sizes and speeds.

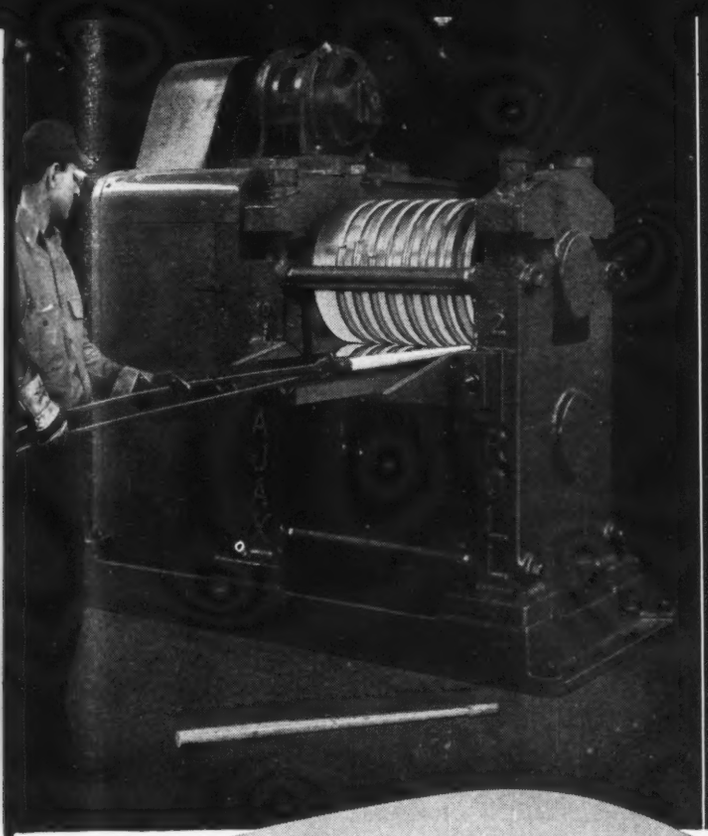
This POPE Cartridge Type Spindle, flange mounted in a heavy housing, is recommended as a headstock on special purpose, high production lathes and on boring machines.

POPE **POPE MACHINERY CORPORATION**

ESTABLISHED 1920

261 RIVER STREET • HAVERHILL, MASSACHUSETTS

BUILDERS OF PRECISION SPINDLES



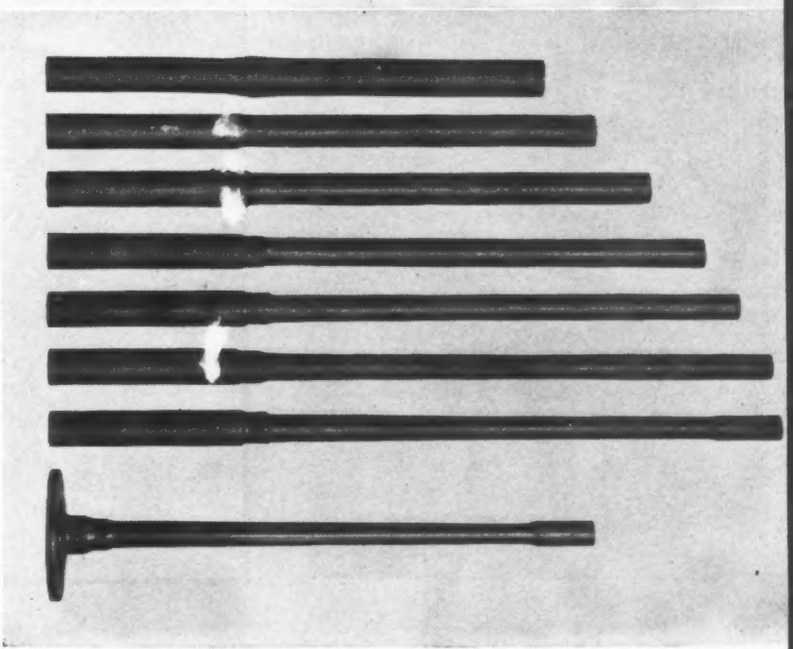
AJAX FORGING ROLLS Taper Rear Axle Shafts

AJAX Forging Rolls are used extensively advantageously in the forging of ...ed automobile and truck rear axle drive shafts. The rolls form the tapered section between wheel seat and spline—accurate, smooth and free from seams or flash lines which would start fatigue failures. After straightening, no machining is done on this tapered section.

When called for, the tapered wheel seat can be rolled at the same heat. When a flange is required, the end is reheated and upset accurately and close to dimensions in an Ajax Forging Machine.

Write for Bulletin 91-A

Ready for Flanging on AJAX FORGING MACHINES



Steps in Rolling a 16 Pound Flanged Axle Shaft

THE AJAX MANUFACTURING COMPANY

EUCLID BRANCH P. O. CLEVELAND 17, OHIO

110 S. DEARBORN ST. • CHICAGO 3, ILLINOIS

DEWART BUILDING • NEW LONDON, CONN.

How Sound Metal Structure

● A design engineer who would avoid the pitfalls of misapplication that often penalize development work will derive from this case history, of a permanent-mold-casting, the basic reason for seeking and inviting the cooperation of a permanent-mold-casting engineer or metallurgist, or both, while the part is still in the design stage. Here is evidence that substantiates the claim that utmost care should be exercised in the selection of a permanent-mold-casting source or foundry.

One responsibility of a permanent-mold-casting source is to acquaint design engineers with the problems of mold designers and foundrymen and to guide them in incorporating features in the design of parts which will facilitate the permanent-mold-casting process and result in sound metal structure throughout the casting. *Such a procedure avoids costly, time-consuming cut-and-dry methods.* Do not allow common sand foundry experience or lack of knowledge regarding the development of permanent-mold-casting designs to impose needless restrictions on quality or mass production of parts or the proper use of permanent-mold-casting processes. Lowest piece price for each part at the point of assembly is usually the result of: (1) Developing and utilizing a permanent-mold-casting technique that achieves the lowest mold cost consistent with the high rate of mass production; (2) Taking advantage of the savings available by the use of metals from re-melt sources; (3) Sound casting quality and minimum scrap loss in machining and finishing; (4) Dependable delivery to meet assembly line schedules.

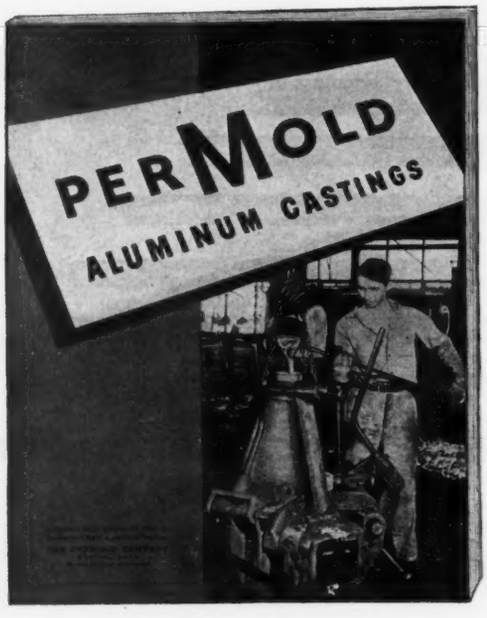
Different permanent-mold-casting techniques result in tangible and measurable differences in the quality of castings. To obtain the utmost of every advantage available in permanent-mold-castings, select the source that is fortified by scientific knowledge and broad experience concerning the physical and mechanical properties of available aluminum alloys, whether from virgin or re-melt sources, and the behavior of these alloys in fabricating parts. The vital element in obtaining sound casting quality is skill and experience in utilizing the correct alloy and employing the correct permanent-mold-casting technique.

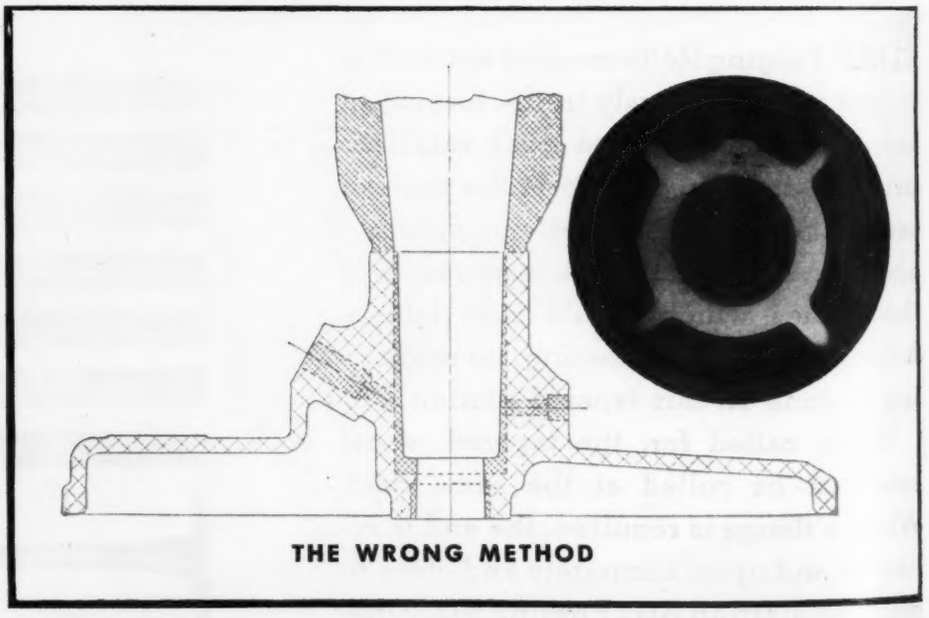
A Permold Engineer or Metallurgist, backed by 27 years of engineering and metallurgical experience and by 24 years of foundry experience, can help you avoid unnecessary experimentation and assist you in obtaining a permanent-mold-casting of sound metal structure throughout. Ask a Permold Engineer for a copy of technical booklet which tells how to utilize to the utmost the excellent physical properties and heat treatment potentialities of aluminum alloys.

perMold

THE PERMOLD COMPANY

870 West Liberty Sreet • MEDINA, OHIO • 28 Miles Southwest of Cleveland





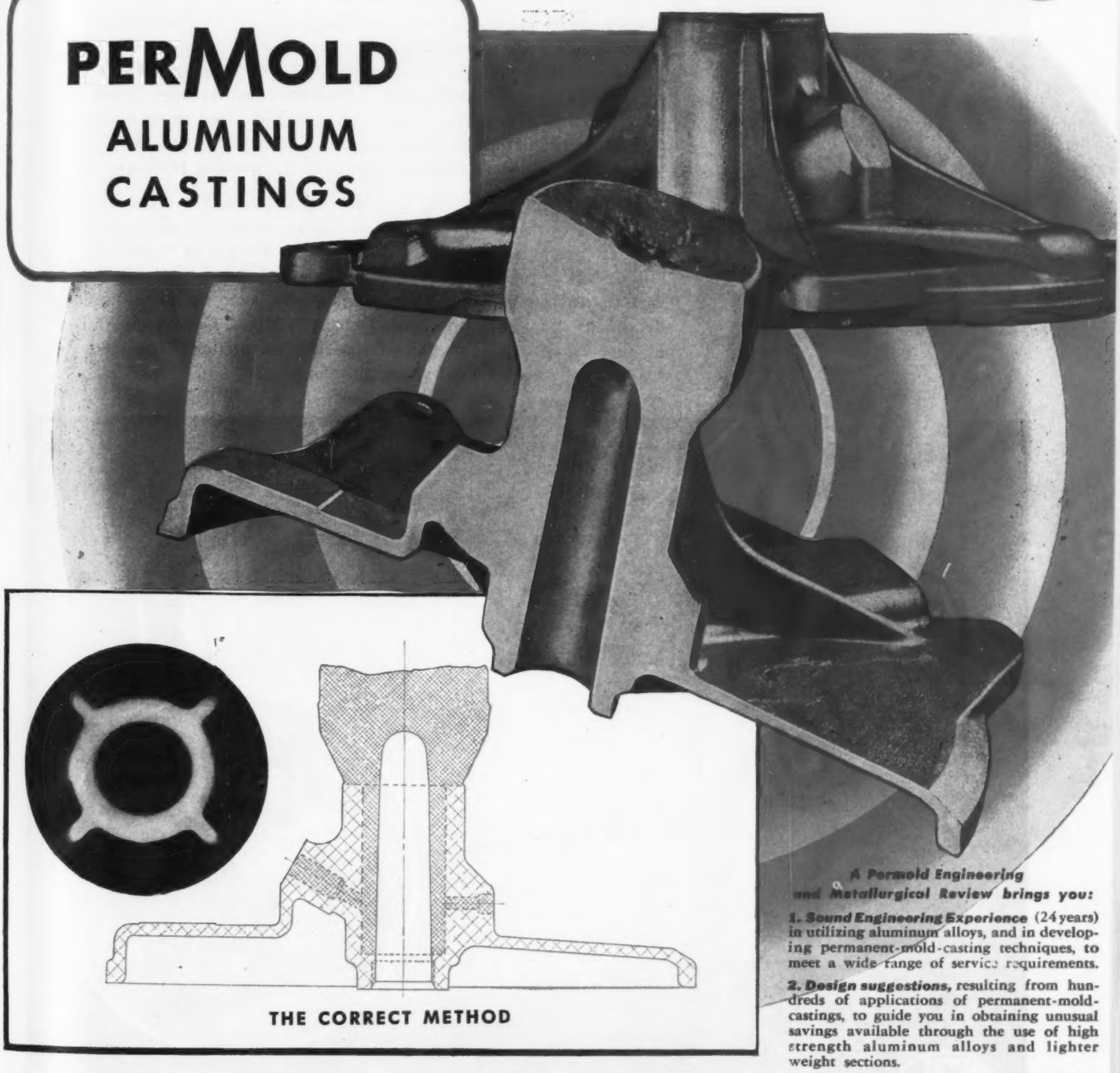
THE WRONG METHOD

Write for copy of Technical Reference Booklet PMC 45, which presents practical suggestions for designing parts for aluminum permanent-mold-casting techniques and a brief treatise on aluminum alloys that are suitable for permanent-mold-casting. This booklet has been prepared especially for the guidance of design engineers, metallurgists, production and management executives, who must determine when, where, and how to employ permanent-mold-castings, and to obtain lowest piece price for each part at the point of assembly.

This casting is part of an assembly containing liquid under pressure and must be leak proof. This part was originally produced as a die casting, but castings made by this process were found to be unsatisfactory because of high scrap loss due to leakage at point of assembly. When it was decided to have the part made as a permanent mold casting, it was recommended by Permold Engineers and Metallurgists that in order to obtain sound structure throughout the casting it should be made as shown in detail of "Correct Method." This involved a considerable amount of metal to be removed by subsequent machining operations, which was objected to by the production engineers, and against PERMOLD recommendations the initial permanent mold for casting this part was constructed as shown in the detail of "Wrong Method." When castings got into the production line and were fully machined and brought to the point of final assembly, pressure tests showed a high percentage of leakage. This leakage was unavoidable because the design made it impossible to feed heavy sections of the part properly, resulting in shrinkage, which was verified by X-rays at the point where leakage occurred.

is obtained in Permanent Mold Castings

PERMOLD ALUMINUM CASTINGS



THE CORRECT METHOD

Having definite proof that sound leak-proof structure could not be obtained with the design as shown in the detail of "Wrong Method," the customer then authorized the design which permitted the permanent mold to be built as shown in the detail of the "Correct Method" as was originally suggested by PERMOLD Engineers and Metallurgists. The production castings made from this mold were subjected to pressure tests, which established the fact that leakage had been overcome. X-rays were made of the same sections of these castings, substantiating the fact that porosity had been entirely eliminated and sound structure obtained. The design of this casting is such that there are fairly heavy sections adjacent to the main flange of the casting. When the metal in these sections solidifies the sections shrink internally due to crystalline shrinkage, and this shrinkage will result in voids if the metal is not fed from an outside reservoir of molten metal. The design insisted on by the production engineers in their commendable desire to keep machining to a minimum resulted in choking off the feed of molten metal from the outside reservoir at the top of the neck of the casting, due to this section being much smaller than the heavy sections lower down. The design recommended by PERMOLD Engineers and Metallurgists is such that the outside reservoir of molten metal functions fully to feed this shrinkage, thereby assuring sound structure throughout the casting.

A Permold Engineering and Metallurgical Review brings you:

1. Sound Engineering Experience (24 years) in utilizing aluminum alloys, and in developing permanent-mold-casting techniques, to meet a wide range of service requirements.

2. Design suggestions, resulting from hundreds of applications of permanent-mold-castings, to guide you in obtaining unusual savings available through the use of high strength aluminum alloys and lighter weight sections.

3. Recommendations covering correct combinations of physical properties required to meet given service conditions; and how to utilize the excellent physical properties and heat treatment potentialities of aluminum alloys to protect your product against failure.

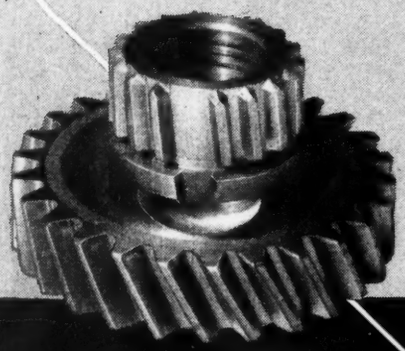
4. Estimates of cost-reducing possibilities which may be realized through the use of permanent-mold-castings and metal from re-melt sources.

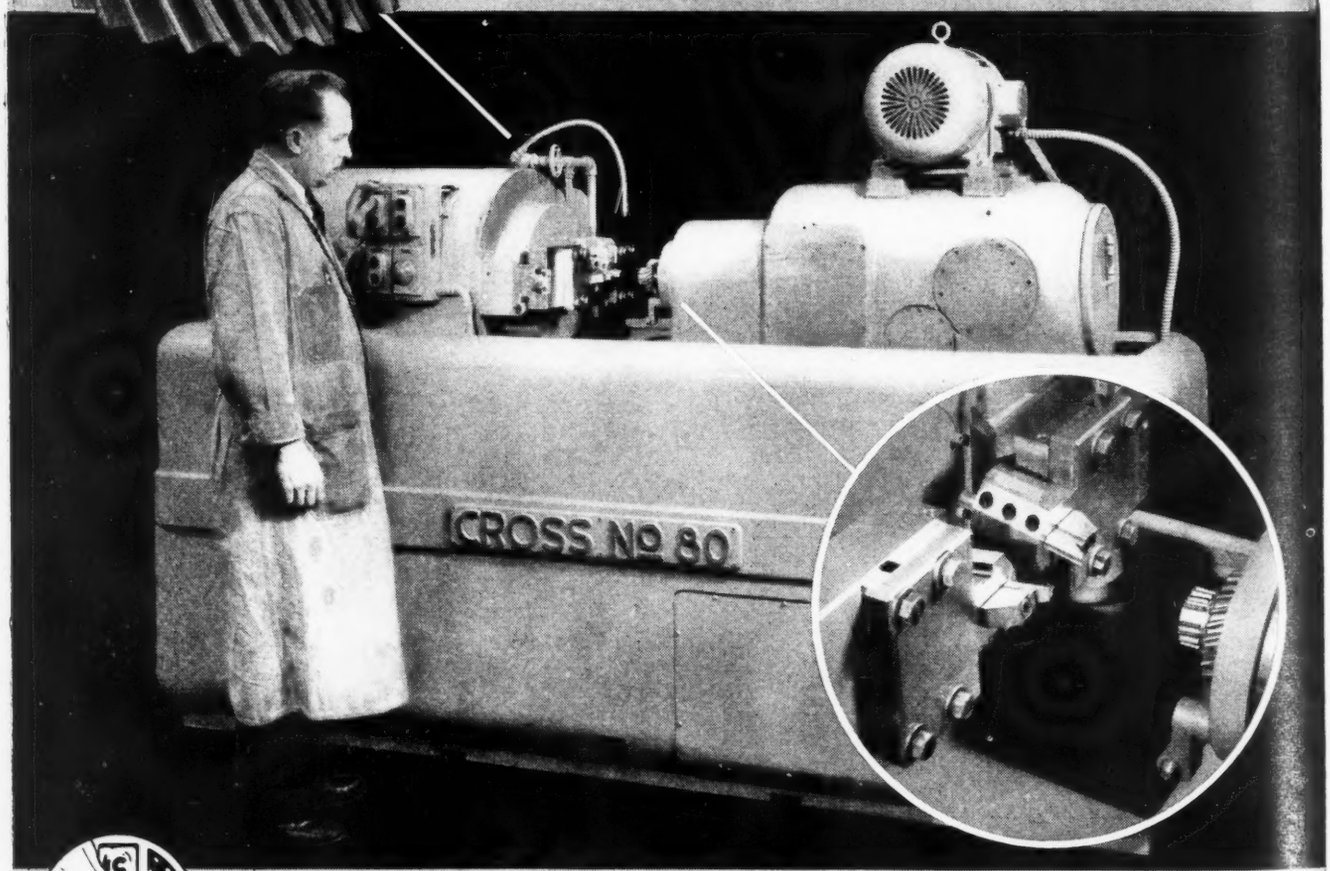
5. Technical facts resulting from comparisons of materials, processes, and costs usually overlooked and unappreciated except by those of broad specialized experience in the highly skilled art of permanent-mold-casting on a mass production basis.

GEAR SHAPER *Extraordinary*

Two tools simultaneously cut two helical slots in transmission gears . . . In a full automatic cycle controlled by push button, the operator loads a part on the arbor and presses a button. The workhead quick-traverses to the tools, where the ram starts its reciprocating helical action as the tools on each side feed in to depth. When the slots are completed, the tool slides withdraw, reciprocation stops and the workhead returns to the loading position . . .

This machine is only one example of Cross engineering that multiplies operator out-put. By producing more, the unit cost is cut and profit is assured, even in today's market of dwindling and uncertain profits. Investigate the possibilities of applying the Cross principle to *your* production. Write, sending prints and details, to The Cross Company, Detroit 7, Mich., Dept. 233. And be sure to ask about the new Cross motion picture "Tools For Profit," available now for group showings.





MACHINE TOOLS

CROSS

ESTABLISHED 1898

SPECIAL MACHINES

TURNING · MILLING · DRILLING · BORING · REAMING · TAPPING · GRINDING

• Chicago • DETROIT • Cincinnati •

The "LONG and SHORT" of It

Scully "Feed as you Need" Chucks

With Scully "Feed as you Need" Chucks you can chuck short or long series drills with only a small portion of the drill extending—thus keeping overhang at a minimum. The drill always has a positive backing against slipping into the chuck.

You need only half as many drills when you use Long-Series Drills for Short-Series work. The saving in Time and Tools is apparent.

The drill is adjusted for depth or overhang without releasing the chuck, by simply loosening the Collet lock nut and twisting the drive collar.

Tool Number	To Accommodate Inclusive Drill sizes	Collet No.	M.T. Shank	Over-all length	Body Diameter	Shank Depth	Projection from Spindle	Depth Drill enters Chuck when completely Drawn in	Depth Drill enters Chuck when completely Extended	Total Adjustment	Price each
	A	B	C	D	E	F	G	J	K	L	$
NA-1	57 To 11/64	A	1	4 1/4	7/8	2 7/16	1 13/16	2 11/16	13/16	1 7/8	17.00
NB-2	1/8 " 9/32	B	2	5	1 1/16	2 15/16	2 1/16	3 3/8	7/8	2 1/2	21.00
NC-3	3/16 " 13/32	C	3	6 9/16	1 1/2	3 11/16	2 7/8	4 7/16	1 5/16	3 1/8	26.00
ND-4	5/16 " 9/16	D	4	7 15/16	1 7/8	4 5/8	3 5/16	5 1/2	1 5/8	3 7/8	33.00

FURTHER INFORMATION AND QUOTATIONS ON REQUEST

Collet Number	For Drill Sizes	Price each
A	57 TO 11/64	2.25
B	1/8 " 9/32	3.00
C	3/16 " 13/32	4.00
D	5/16 " 9/16	6.00

Refer to the Scully-Jones Catalog showing over 500 types and sizes of cutting tools, collet chucks, boring equipment, centers, etc.

Scully-Jones AND COMPANY

1906 SOUTH ROCKWELL STREET • CHICAGO 8, U. S. A.

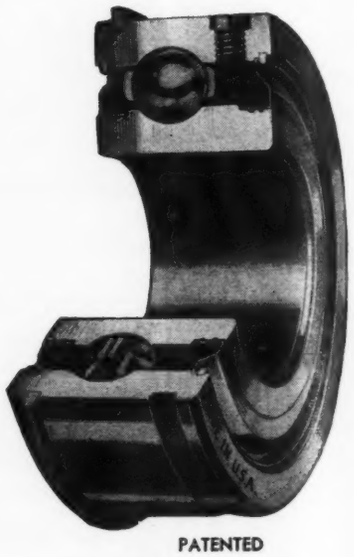
THAT EXTRA SOMETHING...

FOR THE LONG, HARD PULL

IN AN ATHLETE, it is called "STAMINA." In a ball bearing, it is DURABILITY—and it is determined by the inbuilt features that safeguard against wear and break-down.

The NORMA-HOFFMANN "CARTRIDGE" BALL BEARING has all these vital features, developed to the last degree:—wear-less, friction-free, all-metal seals (removable and replaceable) sealing lubricant in and dirt out, regardless of shaft angle; at least double the grease capacity of any other single-row bearing. A design that holds the grease ON THE ROLLING SURFACES, where it is most effective.

Read about these, and other, valuable features of the NORMA-HOFFMANN "CARTRIDGE" BALL BEARING in the Catalog, sent on request. Or, ask our nearest office to have one of our Field Engineers call and explain.

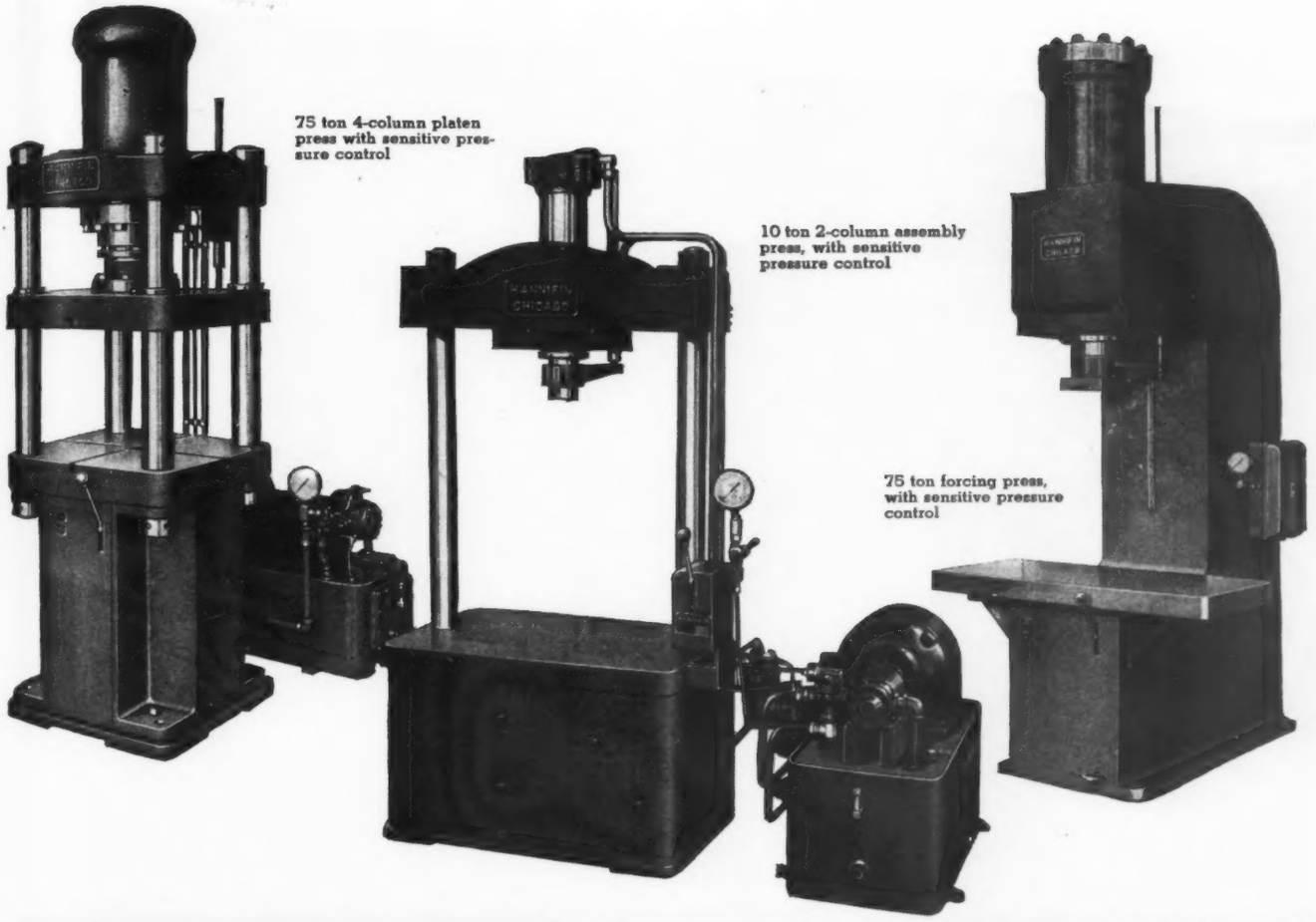


PATENTED

NORMA-HOFFMANN BEARING CORPORATION

STAMFORD, CONNECTICUT ★ Founded 1911

Field Offices: NEW YORK • CHICAGO • CLEVELAND • CINCINNATI • PITTSBURGH • DETROIT • LOS ANGELES • SAN FRANCISCO • SEATTLE, WASH

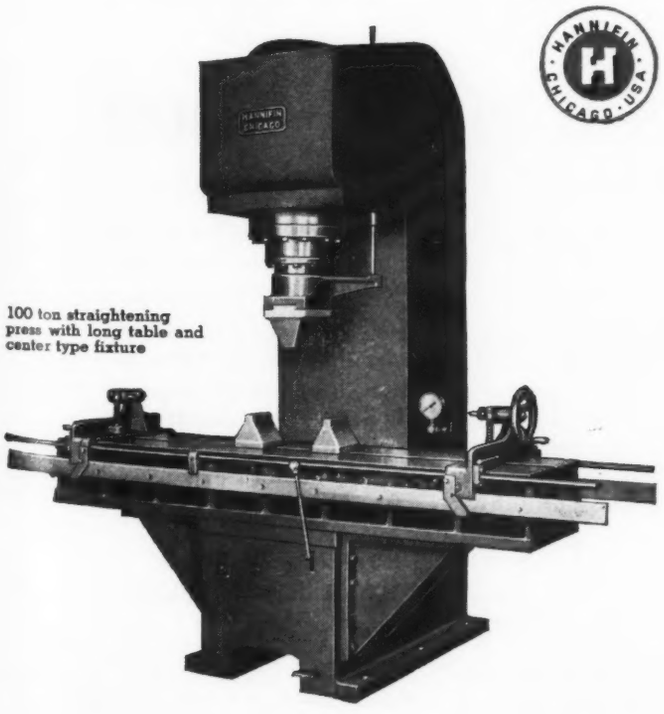


75 ton 4-column platen press with sensitive pressure control

10 ton 2-column assembly press, with sensitive pressure control

75 ton forcing press, with sensitive pressure control

HANNIFIN HYDRAULIC PRESSES



100 ton straightening press with long table and center type fixture

These presses are but a few of the standard and special types developed by Hannifin designers.

Straightening Presses—available from 6 to 150 tons with choice of table lengths and work holding fixtures for work that is centered or for round pieces.

Forcing Presses—from 6 to 150 tons, varying controls, stroke, gap and table construction.

Column Presses—2 or 4 column up to 150 tons, standard and special designs adapted to a great variety of production work.

Their design provides all the advantages of standardized construction, with welded frames and bases, precision hydraulic cylinders, built-in hydraulic power, perfected controls, and provision for simple installation. Flexibility to meet individual needs is readily available, as table construction, column spacing, speeds and controls, and ram stroke can be readily modified. Write for press bulletins.

HANNIFIN MANUFACTURING COMPANY

621-631 SOUTH KOLMAR AVENUE • CHICAGO 24, ILLINOIS

MAKING PAPER AS HARD AS WOOD

COMPRESSING paper discs into hard-as-wood pulleys is the job being done by these sturdy 50-ton Lake Erie Hydraulic Presses. The presses are at work in the plant of the Rockwood Manufacturing Company of Indianapolis, Indiana, producing its well-known line of Rockwood Fibre Pulleys.

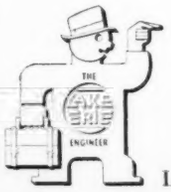
In commenting on the operation of these modern Lake Erie Hydraulic Presses, the Rockwood Manufacturing Company had this to report...

The presses are fast—safe—quiet. They can be set up quickly—save time—increase production. Operating and maintenance costs are low.

Wherever you go in industry, you get the same reports about Lake Erie Hydraulic Presses. They speed production, lower costs, improve product quality. It will pay you to consult Lake Erie Engineers about your pressing problems... it will pay you to install modern Lake Erie Hydraulic Presses.

LAKE ERIE ENGINEERING CORP.
170 Woodward Ave., Buffalo 17, New York
Offices in Principal Cities and Foreign Countries

LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.



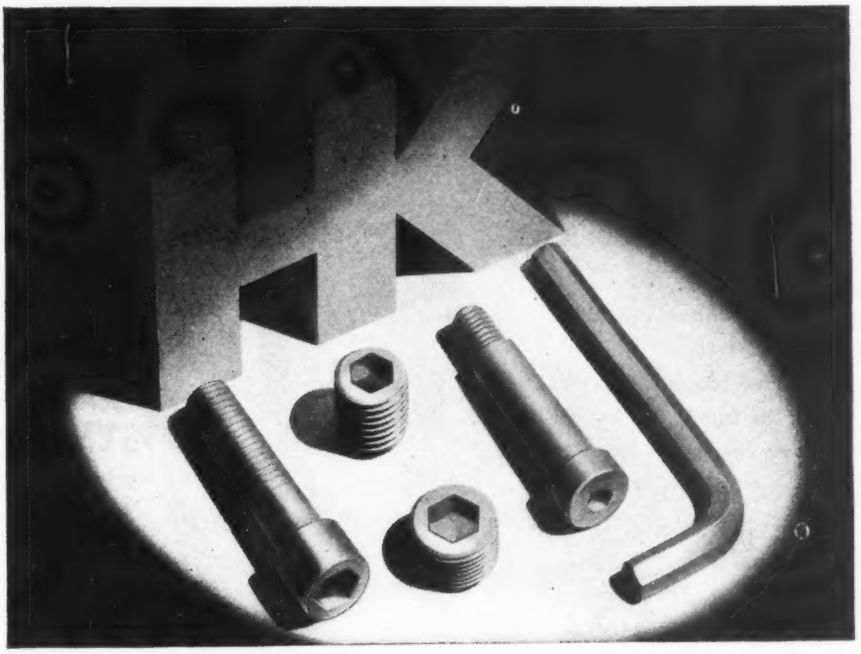
Leading manufacturer of hydraulic presses..all sizes and types..metal working..processing..plastic molding..rubber vulcanizing..stereotyping..special purpose.

HOLO-KROME

fibro forged
TRADE MARK

COMPLETELY COLD FORGED

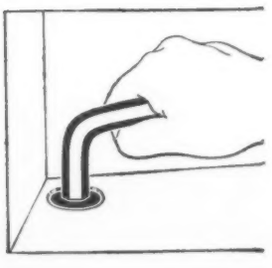
SOCKET SCREWS



The Better Fastening Method

Method owned, controlled, used exclusively by Holo-Krome in the manufacture of Holo-Krome FIBRO-FORGED Socket Screws.

and every single Holo-Krome Socket Screw Product is guaranteed to give *UNFAILING PERFORMANCE*



SOCKET SCREWS
CAP — SET
STRIPPER BOLT
PIPE PLUG - KEYS

THE HOLO-KROME SCREW CORP., HARTFORD 10, CONN.

FACTS ABOUT REAMERS

MATERIAL and hole size both have much to do with selecting the best type of reamer. Shell type reamers are used for large diameter holes. For small holes and in hard, tough, or stringy materials, a solid type reamer is recommended.

Whatever your reaming job, there is a NATIONAL reamer exactly fitted to your needs. In reamers, as in other cutting tools, you get the best when you specify NATIONAL tools—the National choice.

Call Your

DISTRIBUTOR!

Leading distributors in every section of the country have stocks of National Cutting Tools. Every National distributor offers factory-trained engineers to serve you. Call your National distributor for cutting tools or any staple industrial product.

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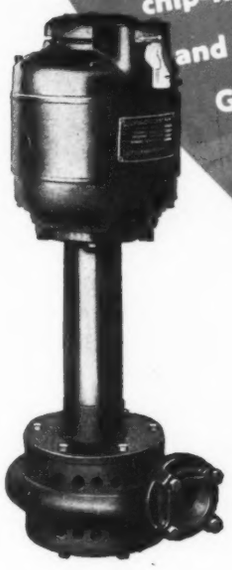
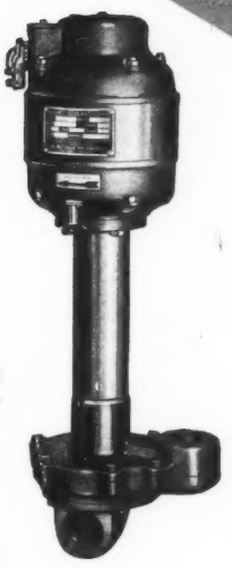
Gusher Coolant Pumps are the choice of leading builders of every type of machine tool . . . and no wonder! Check all these Gusher features and you'll see why: Automatic priming for split-second coolant delivery . . . Controllable volume, from a trickle to full capacity . . . Simple design with fewer moving parts . . . No packing nuts, foot or relief valves . . . Handles grit- or chip-laden coolant without harming mechanism . . . Sizes and types for every job. Let us recommend the right Gusher Pump for your needs. Just send volume and pressure needed, type of coolants to be used, preferred method of installation.

The Ruthman Machinery Company,
1807-1823 Reading Road,
Cincinnati 2, Ohio.



Above: Twin intake, horizontal discharge



Right: Horizontal ell intake at bottom with vertical discharge

Above: Intake and discharge separate through flange

Left: Side intake, vertical discharge

THE COOLANT Heart FOR A GOOD MACHINE

GUSHER COOLANT PUMPS

COMMON SENSE ASSEMBLY ENGINEERING

Saves 11 Troublesome Tapping Operations

Why make fastenings the hard, higher cost way when you can cut assembly time and get stronger fastenings with P-K Self-tapping Screws? Like Electro-Mechano Company of Milwaukee, for instance. Eleven tapping operations eliminated in assembly of their High-Speed Precision Drill Press, some of them at difficult angles. Losses from parts spoilage and broken taps ended. That's *common sense assembly engineering!*

It's just good sense to take a long, thoughtful look at *your* present fastenings and fastening methods. If P-K Screws can be used in your product, they're sure to make a better assembly, at real saving. In 7 out of 10 assemblies submitted to us, P-K Screws permit improvement in strength, and work-hour savings up to 50%.

Ask a P-K Assembly Engineer to look over your assembly and see if it's one of the lucky seven. Or, mail assembly details to us for recommendations. Either way, it's a sensible first step toward making the savings you're missing. Parker-Kalon Corp., 202 Varick St., New York 14.

Sold Only Through Accredited Distributors

Four P-K Type "U" Screws, fasten the name and speed gauge plates. Type "F" Screws fasten the resistor and condenser casing to the motor bracket, eliminate tricky tapping at an angle. Another, below the motor housing, acts as a hardened depth stop. Two others fasten the switch plate.

PARKER-KALON

P-K

SELF-TAPPING SCREWS

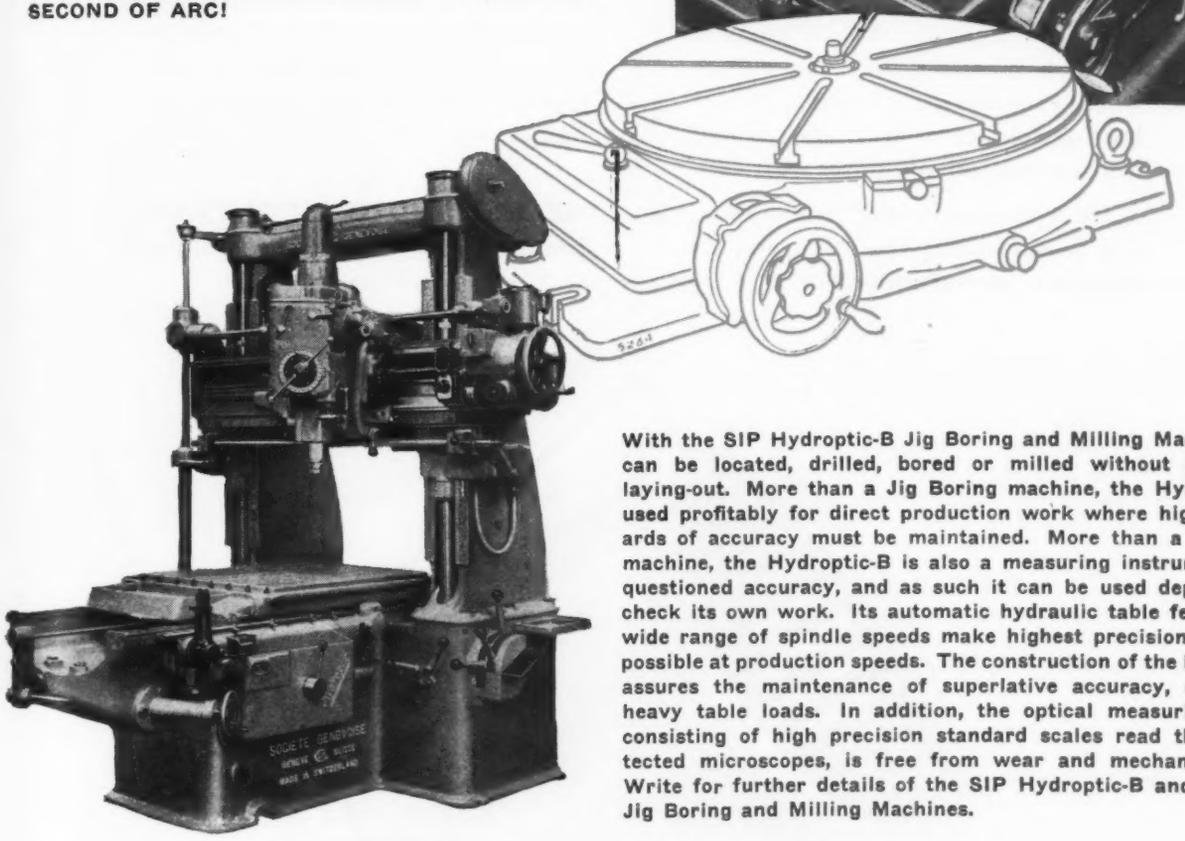
A FASTENING FOR EVERY METAL AND PLASTIC ASSEMBLY

LOCATING AND BORING 28 PRECISION HOLES WITHIN 1 SEC. OF ARC ON THE

SIP HYDROPTIC-B

-no preliminary laying out! -no jigs or fixtures!

All 28 holes on the part shown at the right were bored at one setting on the SIP Hydroptic-B . . . without jigs and without preliminary laying out! The unique optical setting feature of the SIP Hydroptic-B Jig Boring and Milling Machine permits laying out in rectangular coordinates to within 0.0002" limits of accuracy of setting of table and spindle. And, with the circular dividing table, work dimensioned in polar coordinates can be located accurately to within ONE SECOND OF ARC!



With the SIP Hydroptic-B Jig Boring and Milling Machine, work can be located, drilled, bored or milled without preliminary laying-out. More than a Jig Boring machine, the Hydroptic-B is used profitably for direct production work where highest standards of accuracy must be maintained. More than a Jig Boring machine, the Hydroptic-B is also a measuring instrument of unquestioned accuracy, and as such it can be used dependably to check its own work. Its automatic hydraulic table feeds and its wide range of spindle speeds make highest precision operations possible at production speeds. The construction of the Hydroptic-B assures the maintenance of superlative accuracy, even under heavy table loads. In addition, the optical measuring system, consisting of high precision standard scales read through protected microscopes, is free from wear and mechanical stress. Write for further details of the SIP Hydroptic-B and other SIP Jig Boring and Milling Machines.

RANGE OF TABLE SIZES

No. 2C	18" x 10¾"
No. 3K	21½" x 15"
No. 4G	27½" x 23⅝"
No. 5G	43⅜" x 32"
Hydroptic-B	39½" x 32"

We also represent in the United States other world-famous Swiss High Precision Equipment: Andre Bechler —Maag Gear Wheel Co. — Mikron — Safag — Studer — Sallaz — Schaublin — Lienhard — Billeter.

HIGH PRECISION MACHINE TOOLS AND MEASURING INSTRUMENTS

COSA CORPORATION

COSA

CHRYSLER BUILDING
New York 17, New York

It has tremendous capacity for its size!

Where there's a need for high unit capacity, Torrington Needle Bearings furnish the answer to a great number of design problems... one reason also why they serve in such a wide range of applications in so many diversified industries.

Behind this outstanding advantage of tremendous radial load capacity for their size lies the principle of needle bearing design: the full complement of small diameter precision rollers which provides many linear inches of bearing contact surface... assures load distribution and minimizes wear.

There are many other Needle Bearing features important to you as designer, manufacturer or user of mechanical equipment... ease of operation under severe conditions... ability to retain and distribute lubricant evenly over bearing surfaces... low initial cost... and unit construction permitting simple, rapid installation.

If you are not fully acquainted with all the advantages which make Torrington Needle Bearings applicable to *your* product, write for our informative Catalog 32... or for prompt assistance on immediate friction problems confronting you, consult our engineering staff.

•

THE TORRINGTON COMPANY

TORRINGTON, CONN. • SOUTH BEND 21, IND.

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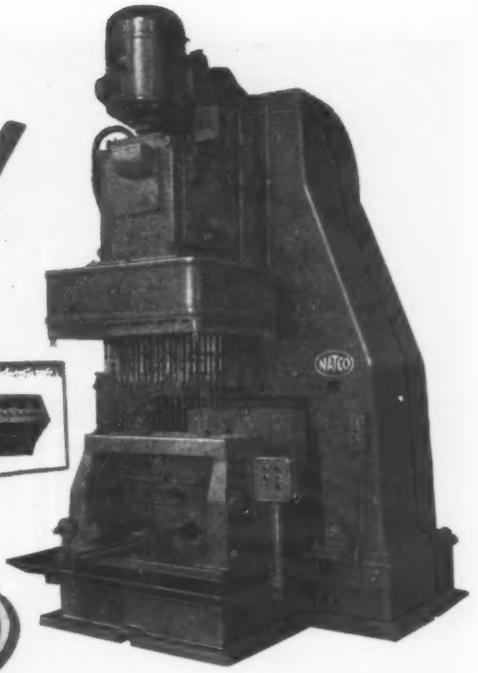
TORRINGTON NEEDLE BEARINGS

NATCO RIGHT ANGLE DRILLER

Composed of Two NATCO Holeunits, Two Spindle Boxes, Column, Base and Fixture

Producing!

47 CYLINDER BLOCKS PER HOUR

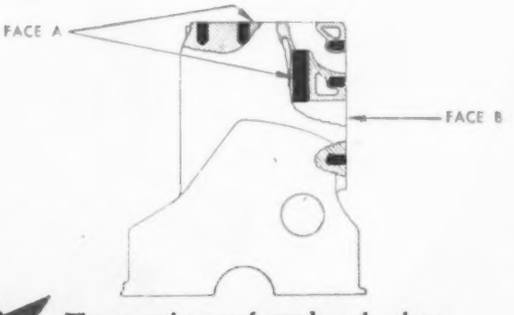


NATCO

The Natco Two Way combination vertical and horizontal machine illustrated is an excellent example of the adaptability of NATCO HOLEUNITS. These units are entirely self-contained and, as shown, are equally as efficient in a vertical mounting as horizontally.

With NATCO HOLEUNITS you can have a way type machine engineered to your exact specifications, with the satisfaction of knowing the entire set-up can be altered or completely rebuilt to meet any design changes, should the need arise.

Call your nearest Field Engineer or Sales Office for complete information or quotations.



The operations performed on the above machine are as follows:

Vertical Unit — Face A
- Drill 16 valve tappet holes.
- Drill 13 water holes.
- Drill 3 miscellaneous holes.

Horizontal Unit — Face B
- Drill 17 manifold stud holes.
- Drill 1 miscellaneous hole.

"NATCO SOLVES YOUR HOLE PROBLEM"

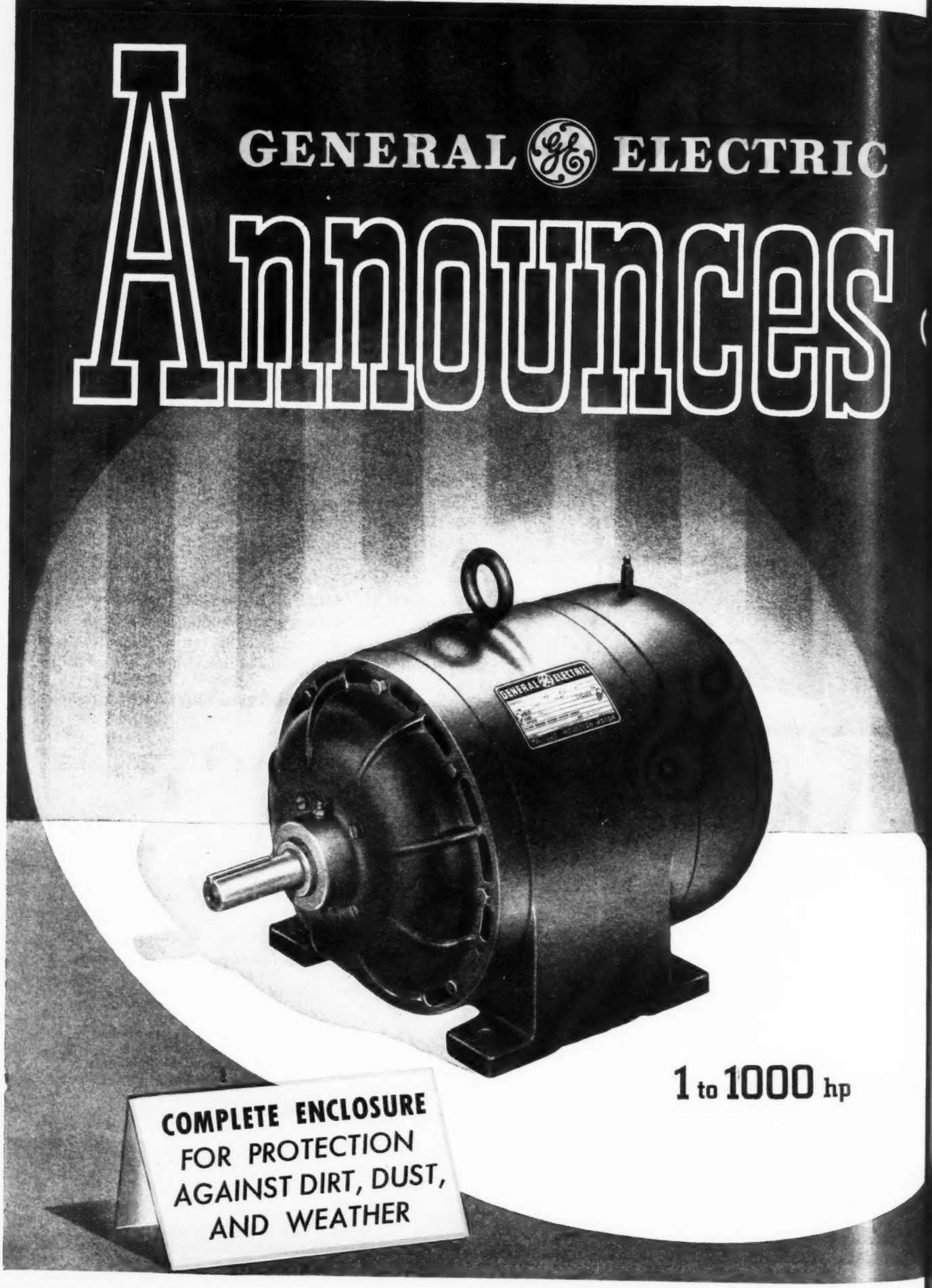
National Automatic Tool Company, Inc., Richmond, Ind.

MULTIPLE DRILLING, BORING, AND TAPPING MACHINES

INVESTIGATE NATCO METHODS FOR THE LOWEST POSSIBLE HOLE COSTS!

SALES OFFICES: 1809 ENGINEERING BUILDING, CHICAGO; 409 NEW CENTER BUILDING, DETROIT;

GENERAL ELECTRIC Announces



NEW

Totally Enclosed

TRI/CLAD MOTORS

REG. U.S. PAT. OFF.

In 1940, G.E. introduced the Tri-Clad open motor—with emphasis on the feature that industry wanted most in a motor, *protection.* Since then, more Tri-Clads have gone into service than any other integral-horse-power motor.

Today, we are ready with a new line of Tri-Clad motors—*totally enclosed, fan-cooled motors*—built on Tri-Clad design principles in both standard and explosion-proof types.

We believe that these are industry's most dependable motors. They are designed specifically for use in many adverse atmospheres—in iron dust, outdoors, in hazardous areas, and chemical atmospheres. Their scope of application is as wide as the field of industrial motor use. Safeguarded against most sources of motor damage, their longer life and lower maintenance will make them economical motors for use on almost every job. *General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

750-281

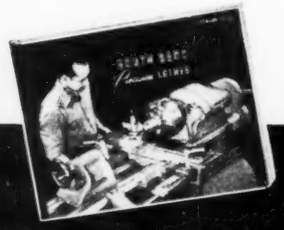
VERSATILE...

FOR A WIDE VARIETY OF PRECISION OPERATIONS

South Bend Precision Lathes offer special advantages to production shops, laboratories, and toolrooms that handle diversified work requiring a wide variety of exacting operations. They simplify change-over from one operation to another; help get new jobs into production quickly and economically. With their wide range of spindle speeds, they machine light metals, plastics, and steel with equal ease. A complete line of attachments and accessories enables South Bend Lathes to handle many operations which otherwise might require special fixtures or machinery. Take advantage of this versatility, coupled with South Bend precision, speed, ease of operation, and dependability, to increase the capacity and efficiency of your shop. South Bend Precision Lathes are made with 9", 10", 13", 14½", and 16" swings, collet capacities to 1", and bed lengths to 12'. Write for complete catalog.

Write For FREE Catalog!

Catalog 100-D illustrates and describes all South Bend Precision Engine Lathes, Toolroom Lathes, and Turret Lathes, gives specifications, shows accessories and attachments. Size 11" x 8½", 68 pages, full color.



SOUTH BEND LATHE WORKS

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LATHE BUILDERS SINCE 1906

WALDES

TRUARC RETAINING RINGS SPECIFIED FOR LEAR'S SERVO ACTUATORS

The Lear Triple Servo —designed for application with the Lear Automatic Pilot.

DESIGNED FOR THE AUTOMATIC PILOT WITH SUPERHUMAN SENSITIVITY

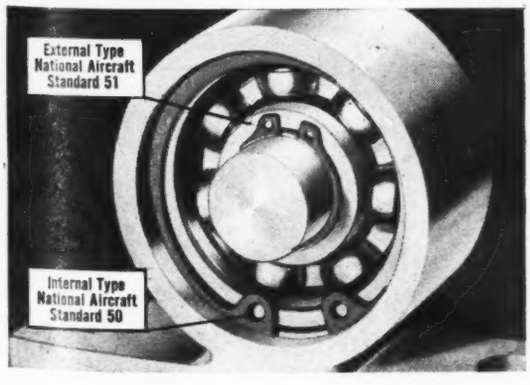
LEAR, Inc.

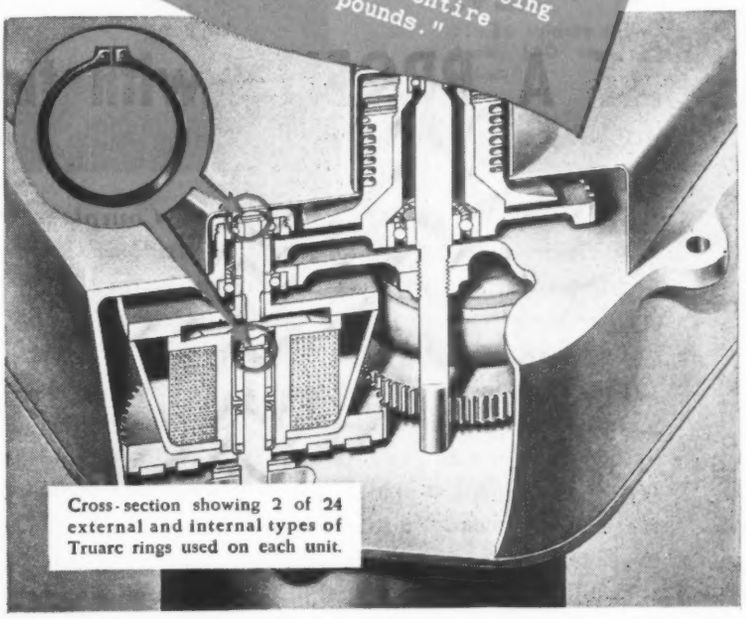
"To eliminate excess weight in our Triple Servo Unit, and make every possible saving of space without loss of power, our design engineers specified Waldes TRUARC Retaining Rings. Retention by any other means was not even attempted. Our experience with Truarc, in other Lear units used in famous aircraft, precluded experimenting with other types of retainers. Truarc has made possible the lightest, most compact unit without sacrificing efficiency. Weight of the entire assembly is only 11.5 pounds."

NOW YOUR MACHINES CAN HAVE THE DESIGN ECONOMY of retaining rings regardless of load, stress or accuracy involved. Waldes TRUARC high precision retaining rings do the job of nuts, shoulders, collars and pins. Yet they allow lighter, more compact units—make assembly and disassembly quicker, easier. TRUARC rings give *better, more dependable* retention because their mathematically precise construction means perfect circularity—insures a never-failing grip. There's a Truarc ring for every mechanical product.

FREE! See how TRUARC can improve your product—cut production and maintenance costs. Write today for Truarc Booklet 23B showing industrial applications and design sketches.

U. S. PAT. RE. 18,144





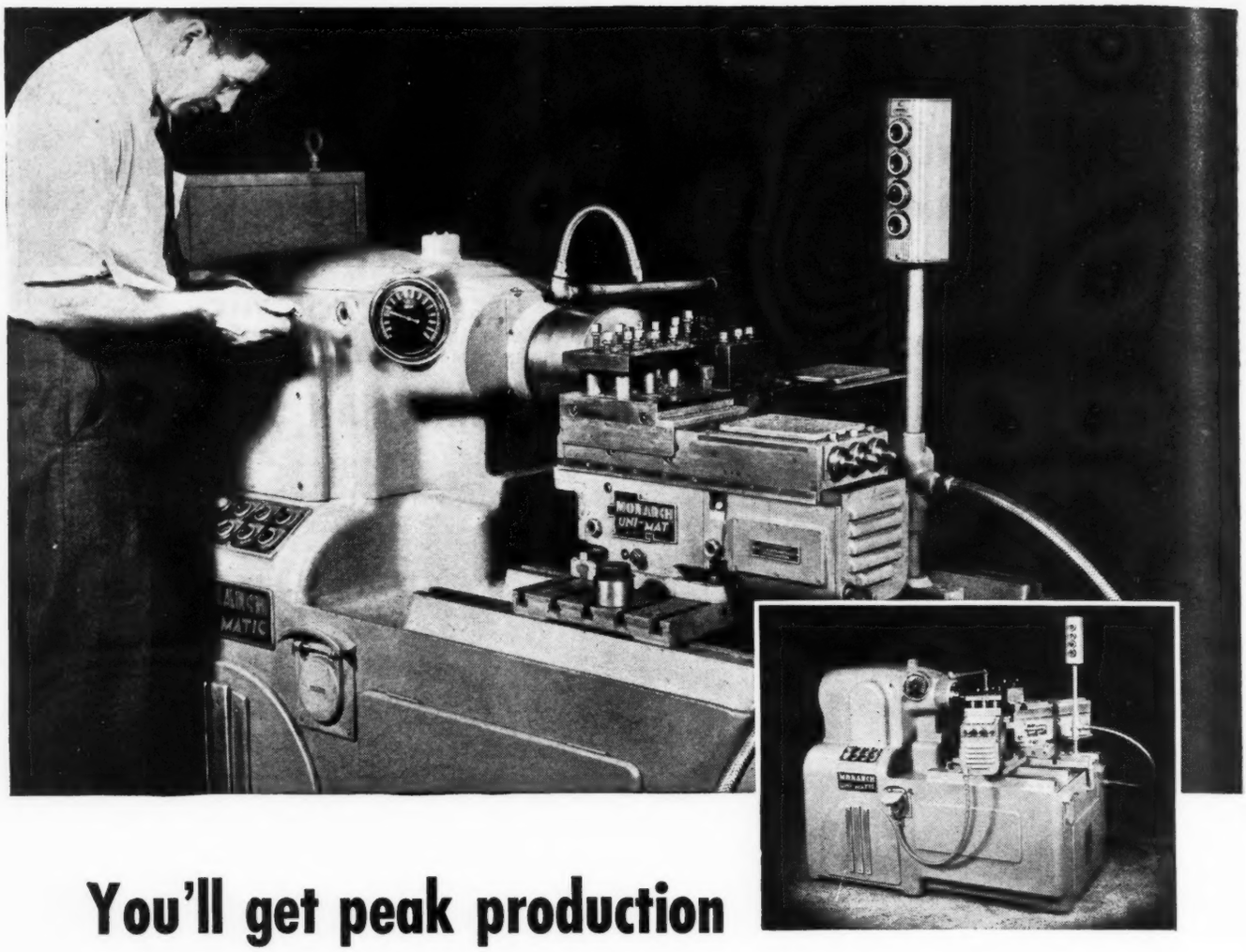
Cross-section showing 2 of 24 external and internal types of Truarc rings used on each unit.

WALDES TRUARC RETAINING RINGS

TRADE MARK

WALDES KOHINOOR INC., LONG ISLAND CITY 1, N. Y.

CANADIAN REPRESENTATIVE: FRENCO PROGRESS AND ENGINEERING CORPORATION, LTD., 72-74 STAFFORD STREET, TORONTO



You'll get peak production AT A PROFIT—with the *Uni-Matic**

Spindle speeds up to 5000 RPM. Completely automatic cycle, electronically controlled. Independent-motor-driven interchangeable tool slides ("Uni-Mats") you can position universally, tool universally.

These are just a hint of some of the revolutionary features you'll find in the Uni-Matic . . . for chucking and fixture work as small as 1" and as large as 16" diameter. It's the machine that brings automatic production within reach of every shop, no matter how large or how small the lots.

You'll get minimum machining costs as only you can with specialized automatic production. Best of all, when you change your design you don't change Uni-Matics. Just tailor the tooling to fit your new operation—it's only a few hours' job. The Uni-Matic is universally adaptable.

* *UNI-MATIC* — Add this new name to your metal-turning dictionary—you'll be hearing a lot of it—wherever rising production costs are a factor. The *Uni-Matic* is Monarch's answer to this problem in the field of chucking and fixture work. For between-centers work it's the *Mona-Matic:* for hand screw machine work, the *Speed-Matic.*

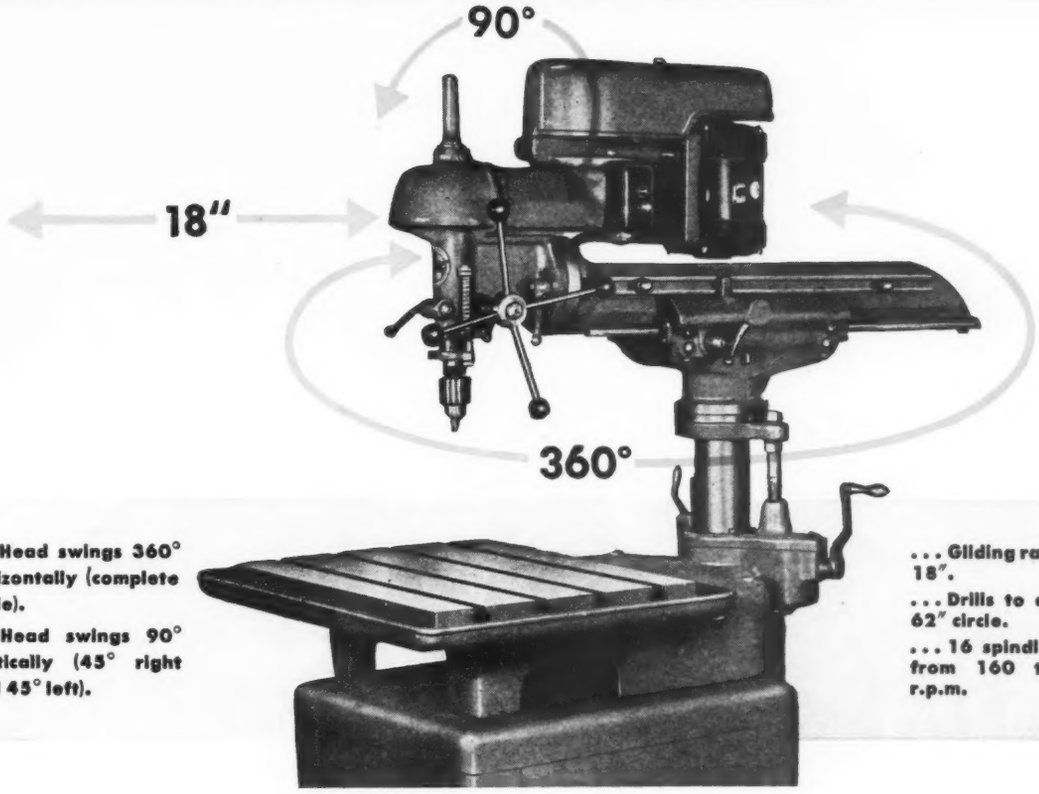
Get full details on these three new machines *now* — from your nearest Monarch representative — or write us direct.

The Monarch Machine Tool Co. · Sidney, Ohio

ACCURACY · ECONOMY · LONG LIFE

Monarch TURNING MACHINES

Get in the SWING and cut costs with Walker-Turner RADIAL DRILLS



. . . Head swings 360° horizontally (complete circle).

. . . Head swings 90° vertically (45° right and 45° left).

. . . Gliding ram travels 18".

. . . Drills to center of 62" circle.

. . . 16 spindle speeds from 160 to 8300 r.p.m.

IF you're drilling, tapping or reaming holes up to ½" in large workpieces . . . Walker-Turner Radial Drills are the answer for faster production and lower cost per piece.

Within their drilling capacity, these versatile machines have a greater range than standard drill presses . . . are easier to operate and simpler to control than heavy radials. Low first cost, low upkeep and low power consumption are other important advantages of Walker-Turner Radial Drills.

Walker-Turner machine tools are sold only by authorized Industrial Machinery Distributors.

For complete description, send for our latest catalog.

Walker-Turner Company, Inc., Plainfield, N. J.

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MACHINE TOOLS

DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT-OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

S is for Service
"S" is for the Service you receive from Winter Taps, the extra holes per grind, the clean-cut threads, the extra long useful life. "S" is also for the Service and close cooperation you receive from the Winter Brothers engineering staff in working out new tapping problems and new techniques.
WINTER
S also stands for another Service
— the prompt Service you receive from your local mill supply man who is familiar with your problems and is always ready to help you. He is as near to you as your phone. "S" also stands for the full Stock of Winter Taps he carries on his shelves ready for immediate delivery. For Service with a capital "S" always specify Winter Taps — from your local distributor.
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COMPANY
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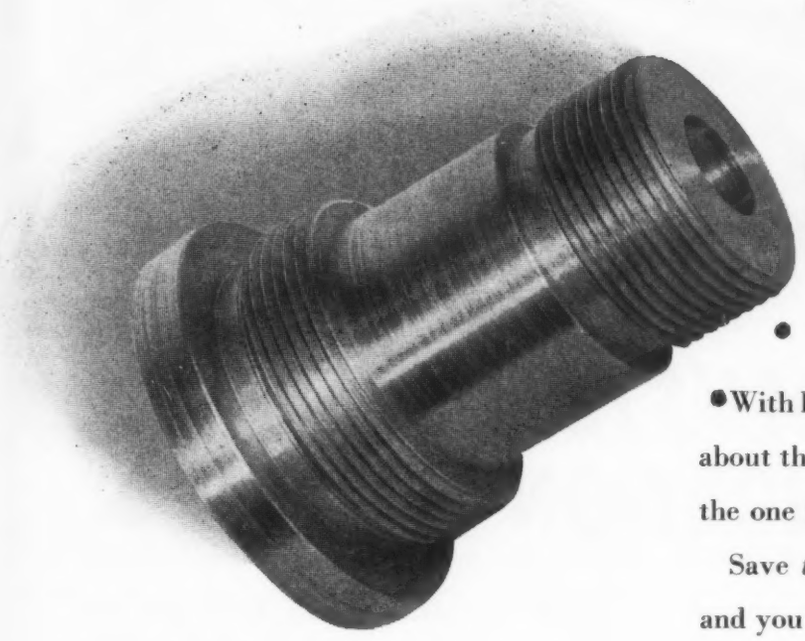
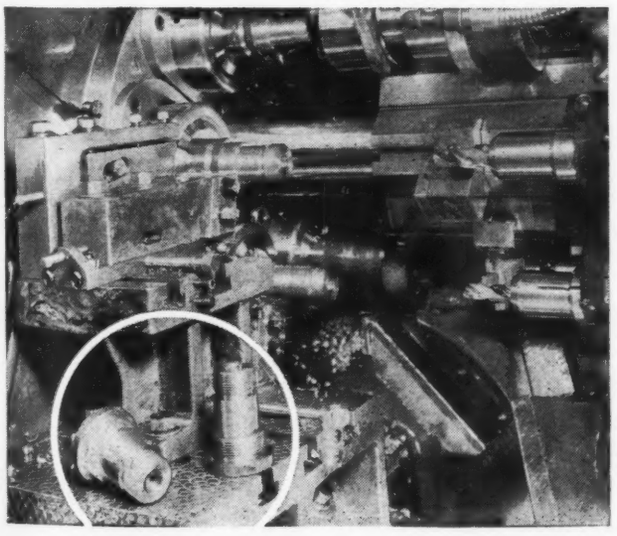
A DIVISION OF THE NATIONAL TWIST DRILL & TOOL CO., ROCHESTER, MICHIGAN

FASTER . . . . . - - less than 20 seconds!





With basic material costs and basic wage rates about the same for you as for your competitors, the one factor you can control fully is *method*.

Save *time* by better methods of production and you reduce cost.

Take for example the steel sleeve shown above, 2½ x 3¼". The 16 operations on this part are done on a 2⅝" six spindle Acme-Gridley Bar Automatic in less than 20 seconds.

Heavy roughing cuts and fine finishing produce consistently high accuracy in this fast time. Two Vers-O-Tools with ground thread circular chasers were used for the threading.

Feel free to ask us for Acme-Gridley time estimates on any precision parts you turn out in quantities — on either bar or chucking equipment.

The NATIONAL ACME CO.

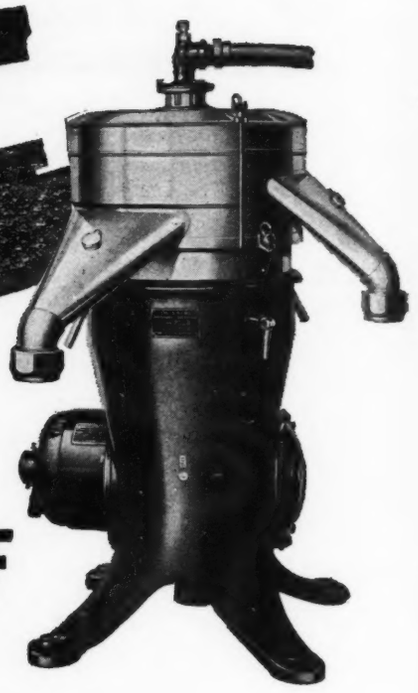
170 EAST 131st STREET • CLEVELAND 8, OHIO

COLLETS AND PUSHERS

The design, materials and methods of processing GENUINE Acme-Gridley Collets and Pushers are vital to continuous low-cost performance on your Multiple Spindle Automatics.

Bulletin CP-45

DRY... CLEAN... and FAST...



THE THREE 'MUSTS' OF OIL PURIFICATION

DE LAVAL Oil Purifiers continuously remove from factory oils both water and dirt or metallic impurities—and they do it very much faster than other available means. Centrifugal force instantaneously separates out any undesirable moisture, whether a scant cupful or many gallons per tank of oil. Thus lubricating oil, hydraulic oil, slushing oil, vacuum pump seal and other oils which must be kept dry are constantly maintained in best condition by De Laval centrifugals.

Those oils demanding constant freedom from solid impurities—such as honing oil, grinding coolant or parts-washing solutions — are also maintained more efficiently by means of a De Laval machine. Such oils not only can be kept more completely free of foreign matter but they, too, can be reclaimed most quickly. In fact, all machine shop oils can be maintained as part of a continuous-flow system.

There are many other uses for De Laval centrifugals in metal-working plants, all of them profitable and time-saving.

Write for Bulletin MM-1, sent free on request.

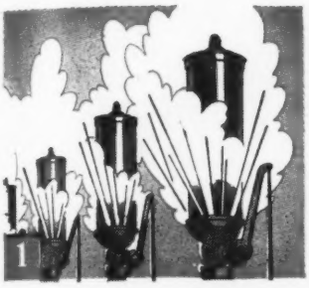
THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

DE LAVAL

PURIFIERS and CLARIFIERS for FACTORY OILS

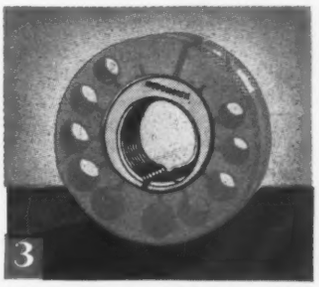
FOR GREATER OPERATING EFFICIENCY

Holy Smokes! They've done it again!

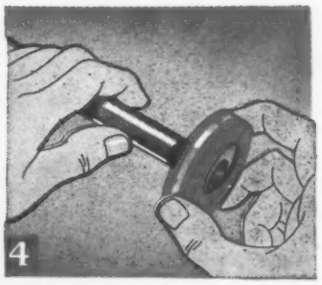


Blow all the whistles! They've done it again!

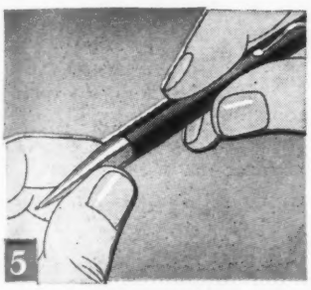
Blast out a fanfare for a great new Woodworth invention!



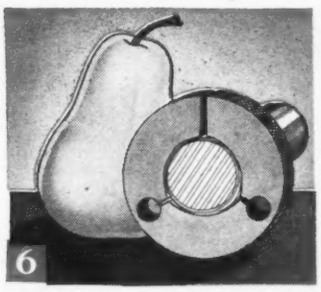
It's the Woodworth Adjustable Thread Ring Gage.



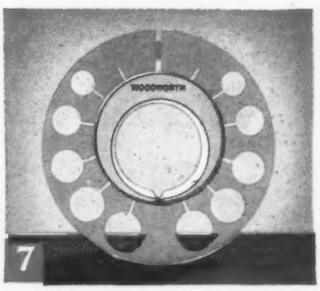
Thread ring gages check the O.D. of threaded parts.



Adjusting 'em as they wear down saves time and money.

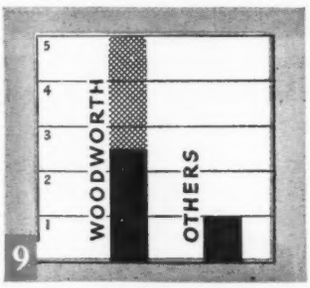


But old types get pear-shaped —lose accuracy—wear out fast.

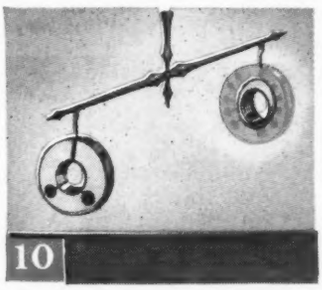


This Thread Ring Gage adjusts perfectly — *stays round.*

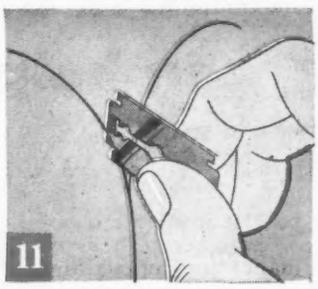
Never gets out of line when dropped or thrown about.



Equal distribution of wear increases life 2½ to 5 times.



Light weight reduces operator fatigue — increases sensitivity.



It's amazingly accurate . . . ideal for hair-splitting work.

Woodworth's New Thread Ring Gage is an all-time champion!

Another Woodworth contribution to production

THE NEW Adjustable Thread Ring Gage, another revolutionary Woodworth instrument of accuracy, is now available to industry!

Employing an entirely new principle of design, and proven mathematically correct by actual tests, this gage assures roundness through the maximum range of adjustment.

Check these
Five Important Advantages

1. *Greater Accuracy and Stability.* Stays round with adjustment. Threads held in alignment of thread helix angle with adjustment. Will not reject parts that should pass inspection.

2. *Longer Wear Life.* Equal distribution of wear over the full thread circumference, throughout the entire range of adjustment, increases wear life 2½ to 5 times.

3. *Less Weight.* Aluminum alloy outer body halves the weight to greatly reduce operator fatigue and increase sensitivity.

4. *Positive Identification.* Green outer body for GO GAGE and red for NOT GO GAGE saves time for operator.

5. *Positive Adjustment.* Cannot be thrown out of adjustment by ordinary blows or falls that change setting of conventional gages.

You can speed up production and decrease gaging costs on your thread inspection operations with this amazing instrument! Write for completely illustrated folder 46-R.

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N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD
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DIAPHRAGM CHUCKS—SPECIAL TOOLS

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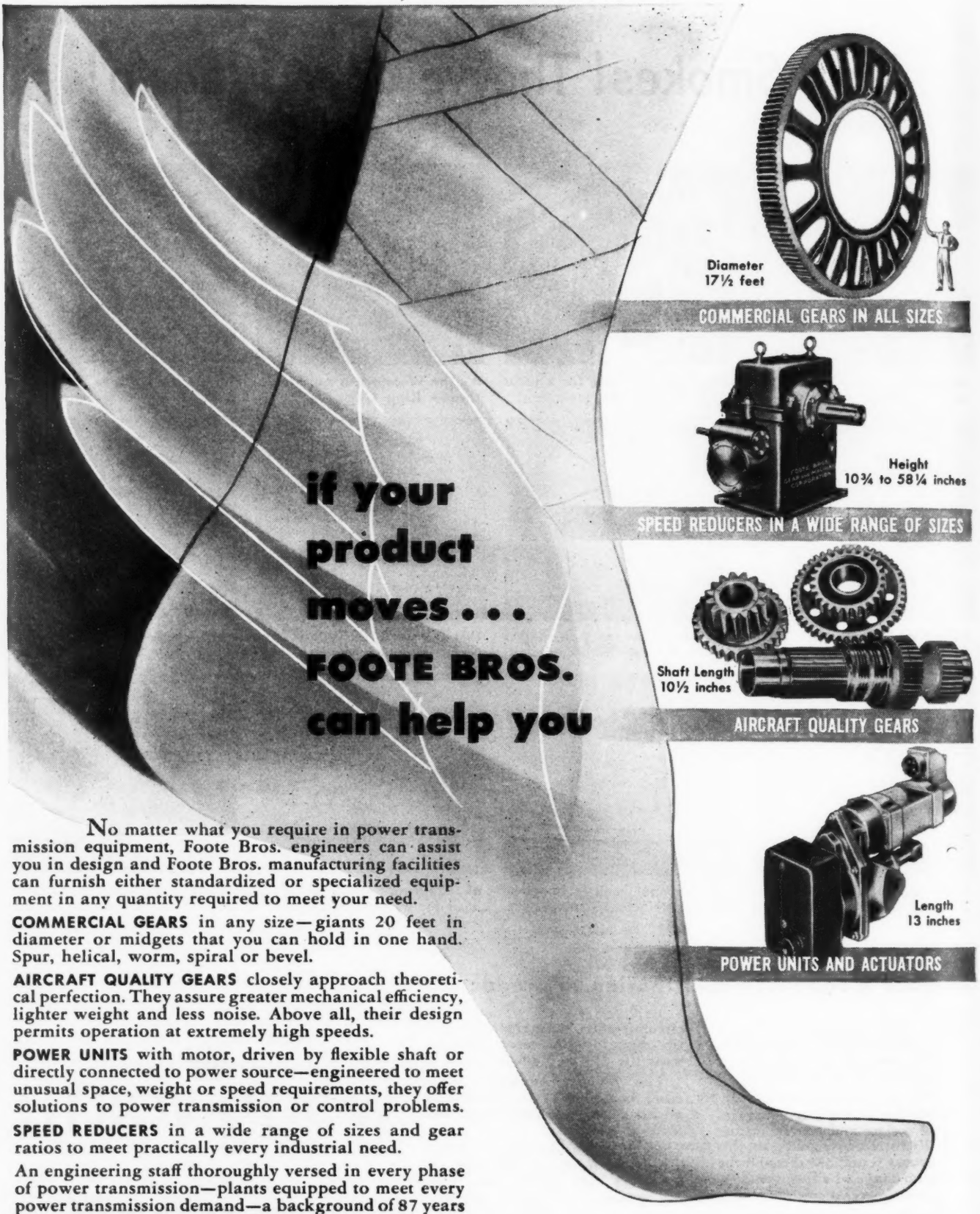

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No matter what you require in power transmission equipment, Foote Bros. engineers can assist you in design and Foote Bros. manufacturing facilities can furnish either standardized or specialized equipment in any quantity required to meet your need.

COMMERCIAL GEARS in any size—giants 20 feet in diameter or midgets that you can hold in one hand. Spur, helical, worm, spiral or bevel.

AIRCRAFT QUALITY GEARS closely approach theoretical perfection. They assure greater mechanical efficiency, lighter weight and less noise. Above all, their design permits operation at extremely high speeds.

POWER UNITS with motor, driven by flexible shaft or directly connected to power source—engineered to meet unusual space, weight or speed requirements, they offer solutions to power transmission or control problems.

SPEED REDUCERS in a wide range of sizes and gear ratios to meet practically every industrial need.

An engineering staff thoroughly versed in every phase of power transmission—plants equipped to meet every power transmission demand—a background of 87 years experience—are ready to serve you.

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Better Power Transmission Through Better Gears

A recently issued bulletin on Power Units giving complete engineering data on "packages of power" will be sent on request. Also available is a bulletin on Aircraft Quality Gears. Write today.

SIMONDS ABRASIVE SEGMENTS

for every chuck

Regardless of the type of segmental chuck on your grinder, you need not pass up the extra values and economies which are yours through the use of Simonds Abrasive Segments. Fabricated to fit every standard chuck, Simonds Borolon (aluminum oxide) and Electrolon* (silicon carbide) segments in all shapes and sizes give superior long lasting performance to produce the best results on your surface grinding operations. Available in every required grain size with Vitrified, Resinoid, Silicate or Shellac Bonds for solid or gap type segmental wheels. For diversified and specialized needs you can count on Simonds Abrasive Segments to demonstrate maximum production efficiency for you.

The same exacting standard of quality which has distinguished Simonds Abrasive products for more than a half century governs the manufacture of Simonds Abrasive Segments.

You will find Simonds Abrasive distributors, located in all principal cities, helpful in recommending the Segments to meet your requirements.

** Time-honored Borolon and Electrolon Abrasive Products are now distinguished by the name Simonds.*

SIMONDS ABRASIVE CO. *is a Division of*

SIMONDS SAW AND STEEL CO.

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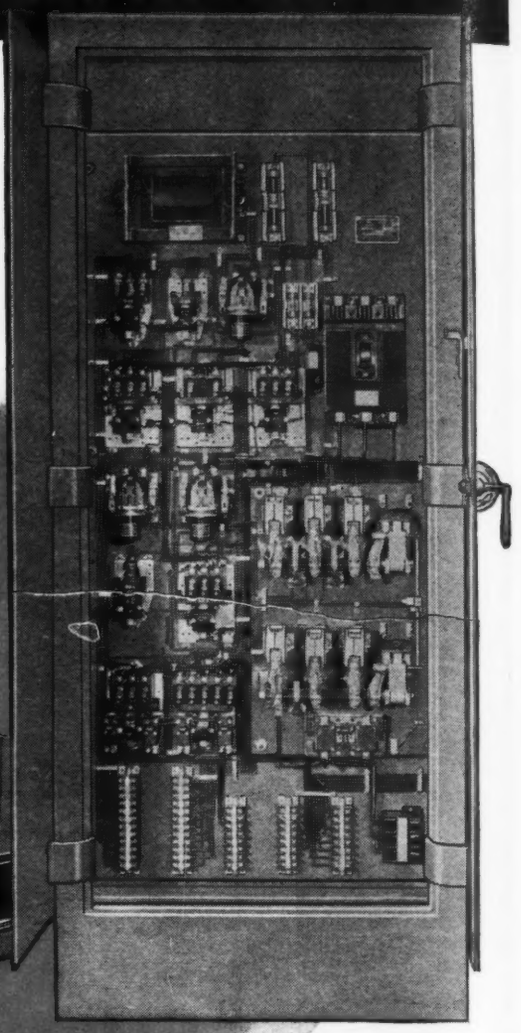
SIMONDS ABRASIVE CO.

SIMONDS ABRASIVE COMPANY, PHILADELPHIA 37, PA. DISTRIBUTORS IN ALL PRINCIPAL CITIES

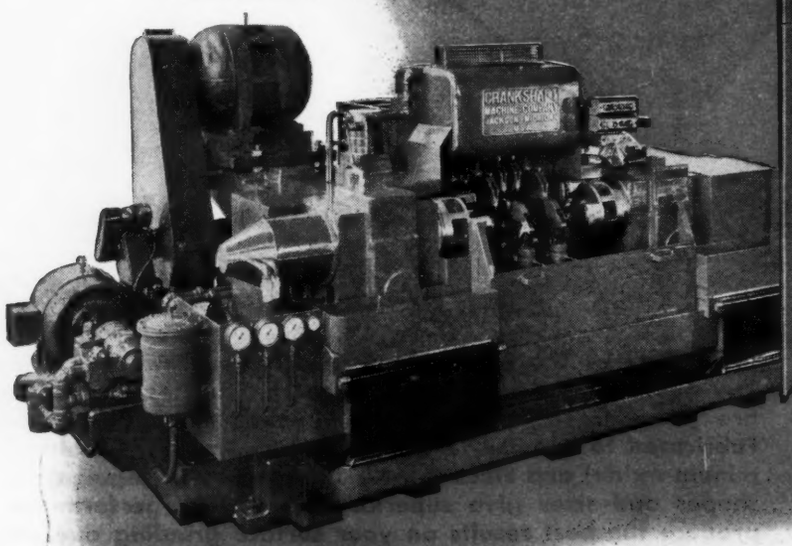
"3C" CONTROL HELPS SPEED PRODUCTION OF CRANKSHAFTS

Crankshaft Machine Company, Jackson, Michigan, builds single purpose lathes to machine crankshafts rapidly, accurately and at low cost—thus helping automotive, aircraft and marine engine manufacturers to handle as many as 45 crankshafts per hour, floor to floor. Machine illustrated is designed to finish-turn crankshaft pin diameters and face pin walls. Clark Control plays an important part by providing full automatic operation.



"3C" Control Panel for Crankshaft Machine. NEMA Type 1A, floor-mounted cabinet.

Crankshaft Machine Co. Type CFB-6LF, Finish Turning Machine.

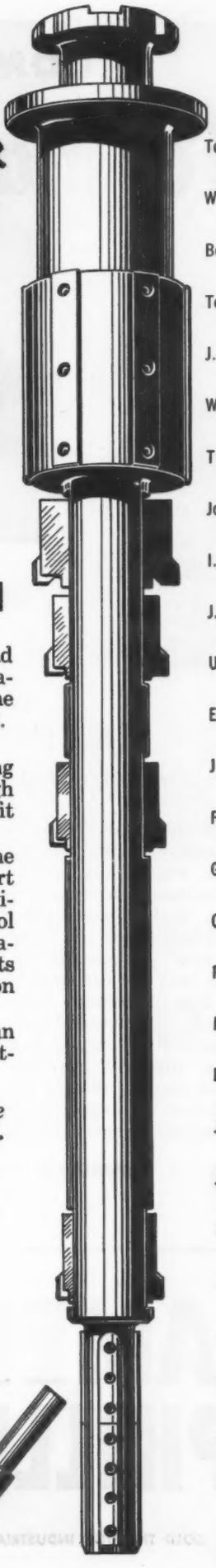


After crankshaft is placed in chucks and starting lever engaged, every operation is automatic. Chucks and steady rests close hydraulically, crankshaft starts to rotate and the table moves to cutters. When machining is finished, table travels to starting position, rotation stops and chucks open. Special controls stop machine if hydraulic pressure drops below required level. If main motor stops, table automatically backs away from cutting tools and machine stops. "3C" Bulletin 100 Type D push-buttons on machine are used for inching during setting up, and for emergency stopping.

Clark specializes in controls for modern, high speed machine tools. Let Clark engineers help you design the proper controls for your equipment.

THE CLARK CONTROLLER CO.

1146 EAST 152nd ST., CLEVELAND 10, OHIO • EVERYTHING UNDER CONTROL



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Gairing is known by the performance of its tools and the men who sell them. The desire of our representatives to be helpful and their intimate knowledge of the field they serve will win your confidence and respect.

Their names are listed at the right.

No matter how simple or complex your tooling problem may be, Gairing engineers, working through these representatives, will gladly give you the benefit of their training and experience.

A tooling program takes into consideration the degree of accuracy and interchangeability of the part to be made and the volume required. Gairing engineers evaluate these factors and develop special tool designs or adapt standard designs for new applications. They make a continuous study of improvements in methods and materials for the regular production of Gairing tools.

This service is yours without obligation. You can easily make use of it through our district representative. Decide today to meet *your* Gairing man.

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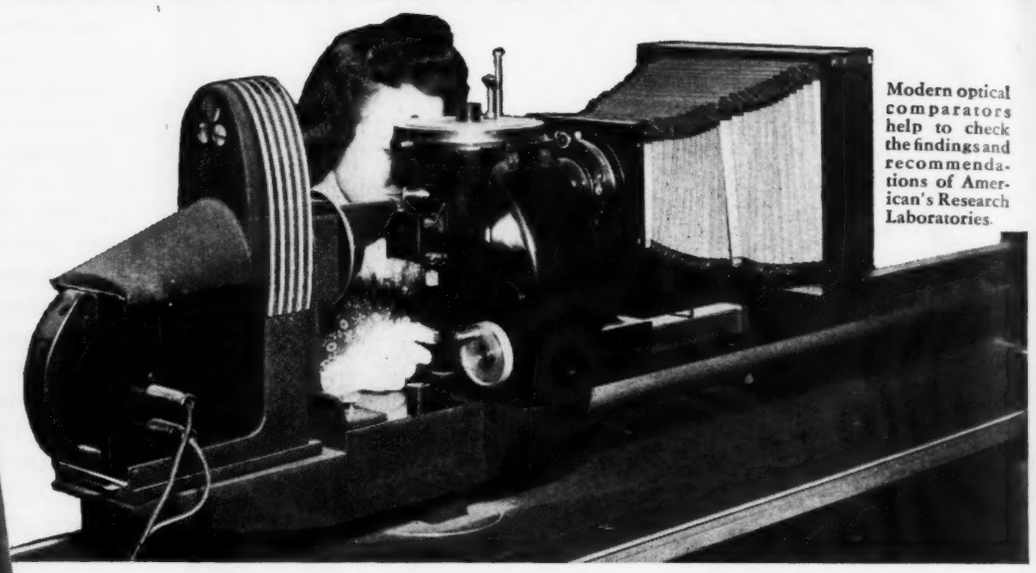
COME TO THE "Information Center"



Modern optical comparators help to check the findings and recommendations of American's Research Laboratories.

. . . for recommendations on AMERICAN PHILLIPS SCREWS of the *right type* and *metal* for *your* job

Here in American Screw Company's Engineering Research Department are the technicians, equipment and experience to work out for you, quickly, the right answer to the question: "What kind of American Phillips Screw . . . standard or special . . . is the best one for *my* job?"

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So bring your problem to the "Information Center," and let American give you extra, *engineered savings* in design and metallurgy . . . in addition to the time-savings (up to 50%) which you always get from the American Phillips Recessed Head: Automatically straight driving, slash-proof protection for work-surfaces, and top speed and ease in handling the 4-winged driver, which fits firmly in the recessed screwhead. Write *now* to the Engineering Research Dept. of:

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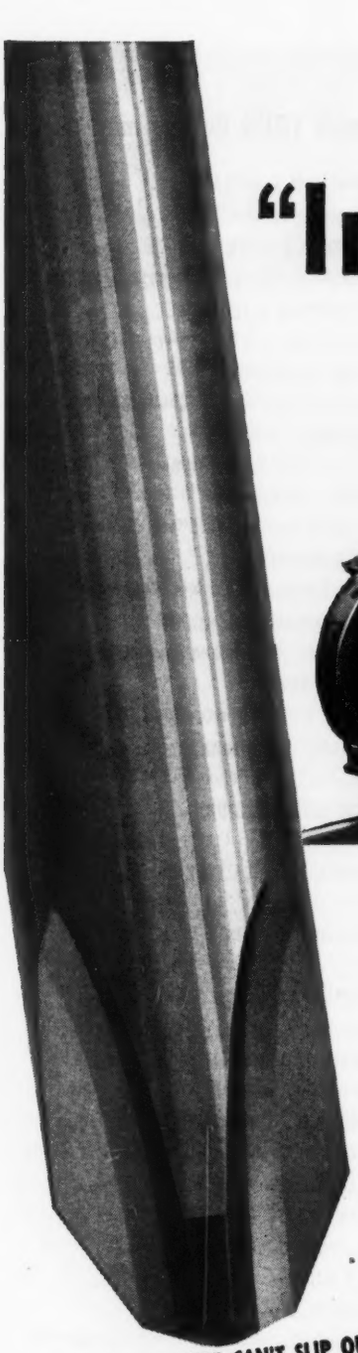
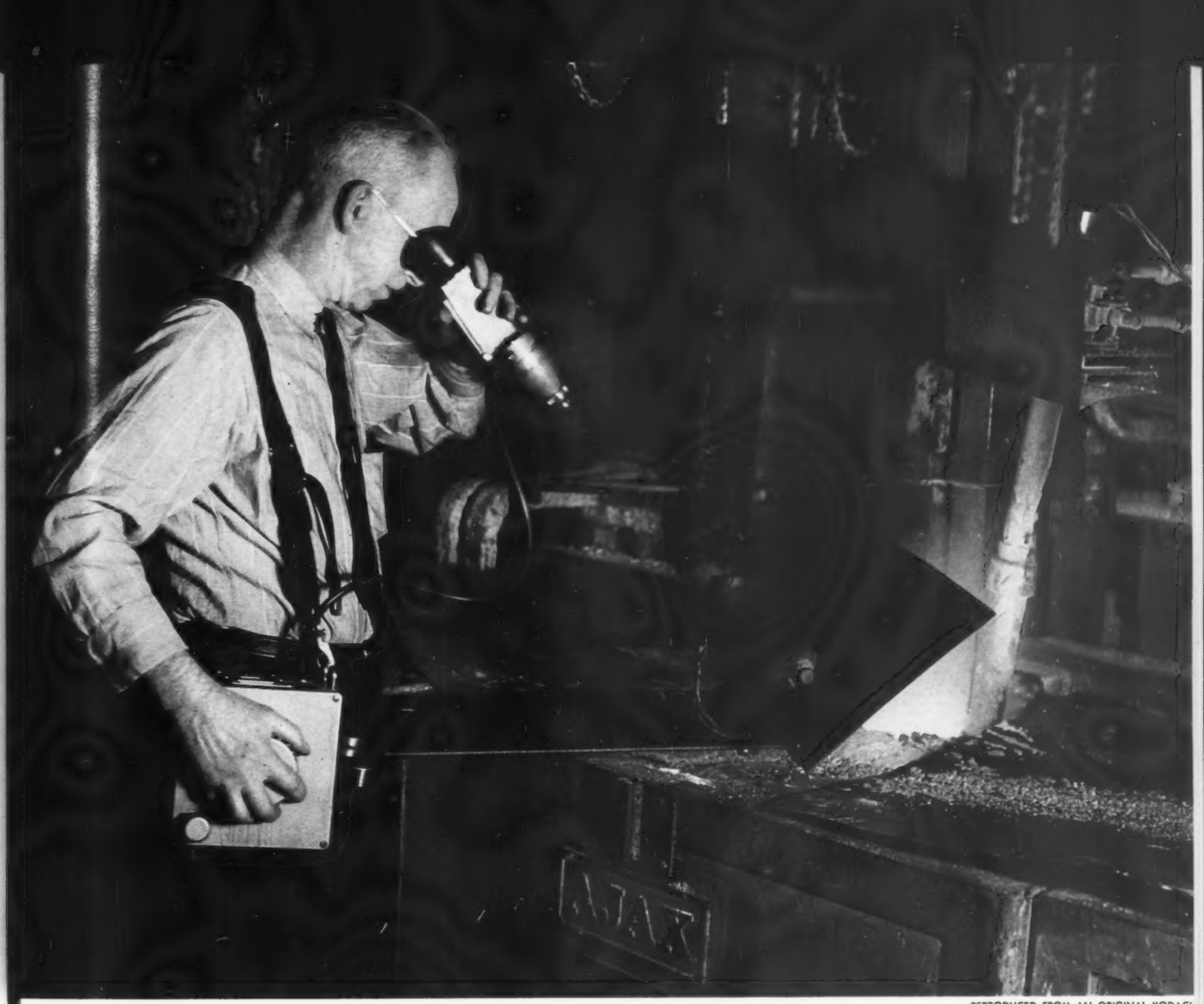


4-WINGED DRIVER CAN'T SLIP OUT OF PHILLIPS TAPERED RECESS

AMERICAN PHILLIPS *Screws*

ALL TYPES
ALL METALS: Steel, Brass, Commercial Bronze, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)

SOLD THROUGH INDUSTRIAL SUPPLY DISTRIBUTORS

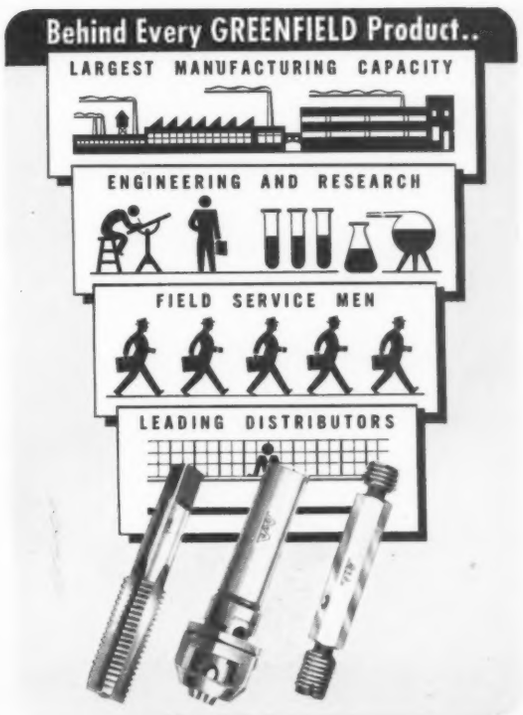


REPRODUCED FROM AN ORIGINAL KODACH

When the tap's in the fire . . .

This "Greenfield" man is measuring heat with as much precision as though he was using a micrometer to measure size. He is using an optical pyrometer. On his technical skill depends to a large degree the performance of the finished product in your plant. Improved furnaces, precise heat measuring devices, and the continuing accumulation of "know-how" have made the heat treating of tool steels an exact science in "Greenfield" plants.

It is a science that contributes much toward your getting *more for your money* when you use "Greenfield" tools and "Greenfield's" "Show-How" field service.

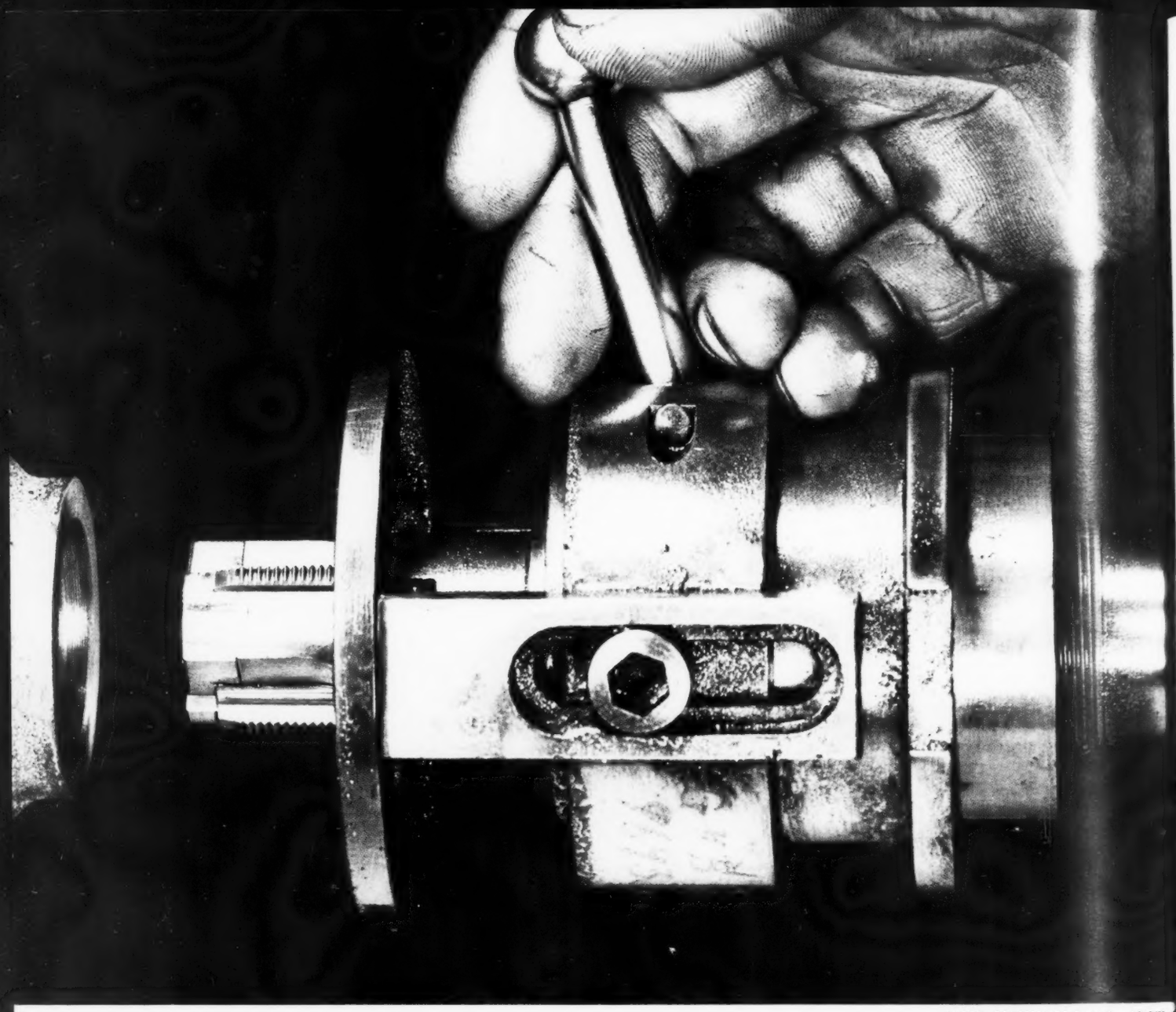


GTD GEOMETRIC

GREENFIELD

GREENFIELD TAP and DIE CORPORATION

GREENFIELD, MASSACHUSETTS



PHOTO, COURTESY OF GILBERT and BARKER M

At his finger-tips . . THREADING PERFORMANCE

This is a simple, rugged tool. It has taken the headaches out of internal threading in hundreds of plants. It is a Geometric "Class S" Collapsing Tap (the type shown above is for stationary use, has a plate trip and is reset by the conveniently placed handle). The "Class S" Tap is suitable for stationary and rotary use and is convertible into different types of trip. In addition Geometric "Class S" Taps can be used on almost any machine and for nearly every threading job over $1\frac{1}{4}$" in diameter. Their reputation is built on their unequalled record of threading performance in leading plants throughout the world.

FOR NEARLY EVERY THREADING JOB — A GEOMETRIC!

If you have in mind a particular threading problem, we will be glad to have our engineers give you their recommendations, based on over a half century of specialization in this field. Why not let us send you the latest Geometric catalog?

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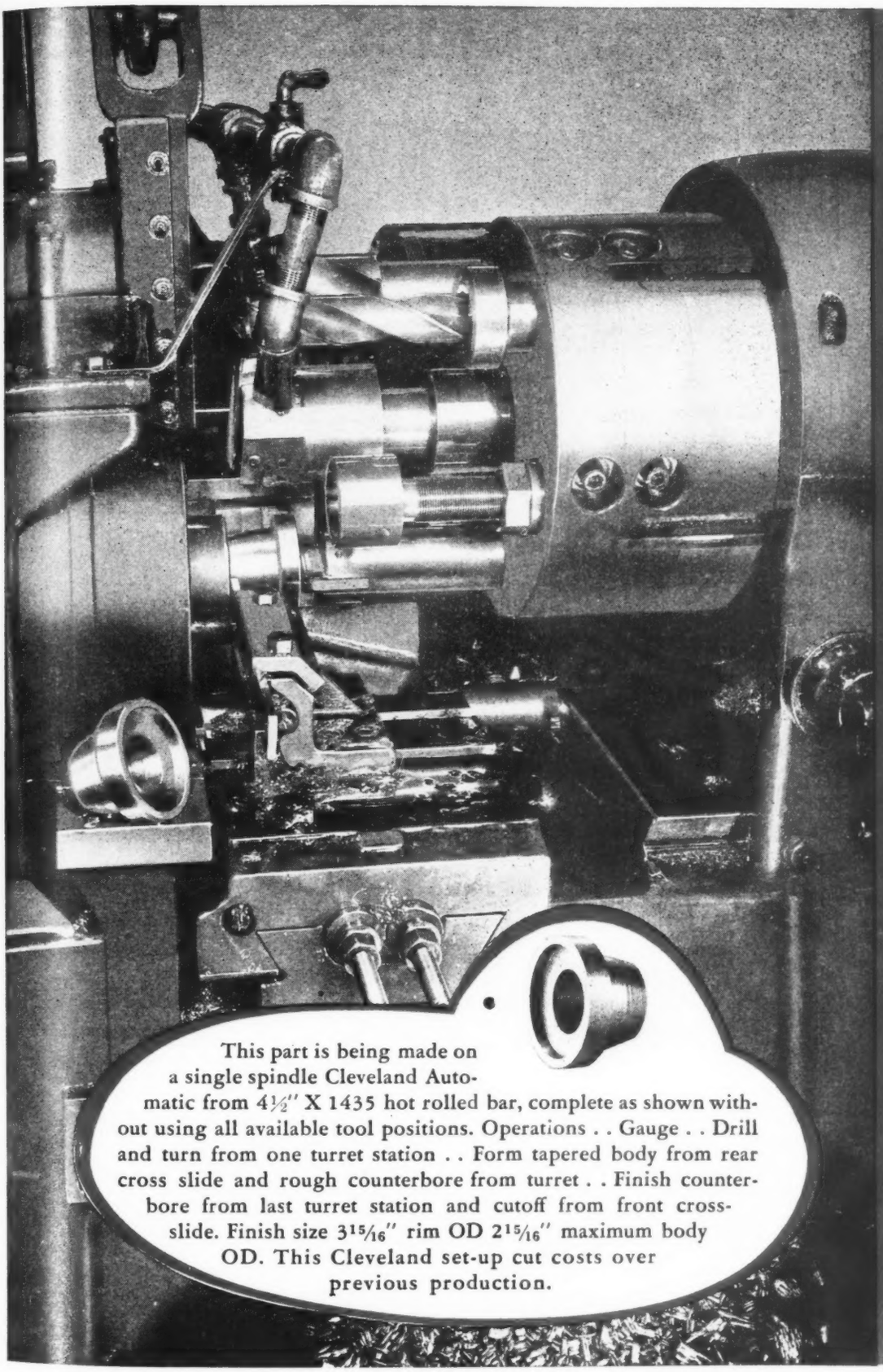
TOOL COMPANY . . NEW HAVEN 15, CONN.

A Division of Greenfield Tap and Die Corporation



MORE COST CUTTING WITH CLEVELANDS

This part is being made on a single spindle Cleveland Automatic from 4½" X 1435 hot rolled bar, complete as shown without using all available tool positions. Operations . . Gauge . . Drill and turn from one turret station . . Form tapered body from rear cross slide and rough counterbore from turret . . Finish counterbore from last turret station and cutoff from front cross-slide. Finish size $3\frac{15}{16}$" rim OD $2\frac{15}{16}$" maximum body OD. This Cleveland set-up cut costs over previous production.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

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Smooth, controlled power movement in any direction

IN thousands of industrial applications, Hanna Cylinders are serving men and machines by supplying safe, smooth, dependable power . . . at low cost. Hanna Cylinders are capable of 1001 jobs that involve a pushing, pulling, clamping, pressing or lifting movement.

The simple compact design and rugged construction of Hanna Cylinders insure long life and freedom from maintenance problems. They are easily installed and will function in any position.

Hanna Cylinders cannot be damaged by overloading. The cylinder will simply stall. Where Hanna Cylinders are to be used under heavy shock loads and high speeds, they can be supplied with cushions at one or both ends.

Consider the operations in your plant and check over the performance of the machines and equipment you build. Chances are you will find places where Hanna Cylinders will do a better job—faster, safer, at less cost.

Standard model Hanna Cylinders are available for practically all applications: Low pressure air and hydraulic cylinders for working pressures up to 250 P.S.I., high pressure hydraulic cylinders for working pressures up to 1500 P.S.I.

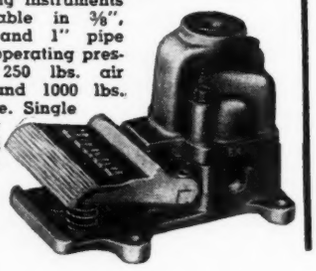
• Ask for these Hanna Cylinder Catalogs. No. 233 on High Pressure Cylinders and No. 230 on Low Pressure Cylinders. They're free. The Hanna Hydraulic Cylinder Calculator provides instant computations on pressure, cylinder stroke, horsepower, size pump required, etc. It's free for the asking.

Hanna unitite valves

• These rugged, packless type instruments are used as control valves for pneumatic and hydraulic cylinders. Used as 3-way or 4-way valves, they are suitable for air, oil or water pressures up to 250 P.S.I. for the ⅜", ½" and ¾" sizes, up to 150 P.S.I. for the 1" size and up to 100 P.S.I. for the 1¼" size. All sizes available in three mounting styles.

Hanna foot valves

• Hanna Foot Valves provide quick, almost effortless control—free hands for holding work, feeding or removing pieces and all the other things that hands alone can do. These time and labor saving instruments are available in ⅜", ½", ¾" and 1" pipe sizes—for operating pressures of 250 lbs. air pressure and 1000 lbs. oil pressure. Single pedal or latched pedal models.



Hanna speed control valves

• Installed between the operating valve and one end of a cylinder, these valves provide adjustable control of inflow and outflow of the air or oil independently to and from one side of the piston. One valve will therefore control the piston speed in two directions. Hanna Speed Control Valves are made for working pressure of 250 lbs. for air cylinders and 1000 lbs. for hydraulic.

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HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

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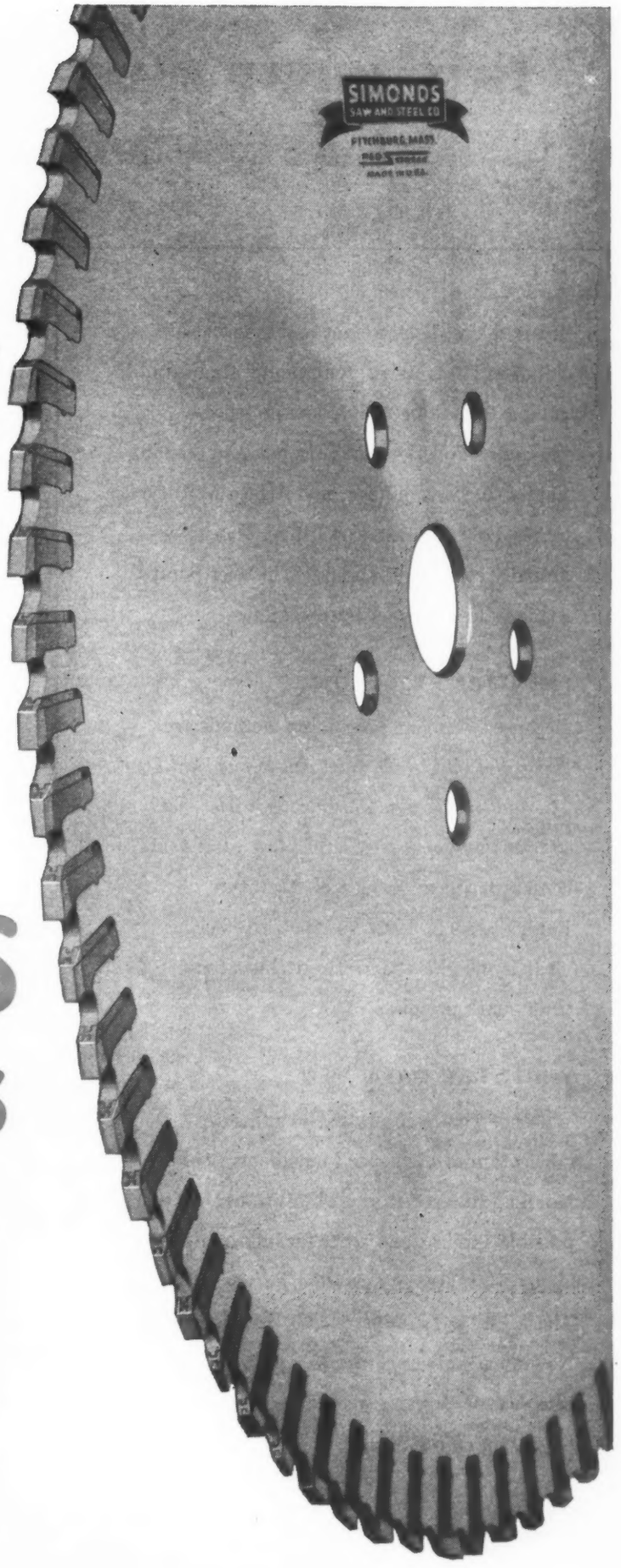

. . . the *Original* Saws with the
CURVED-GULLET TEETH
that permit Faster Speeds
and Feeds . . . Deeper Cuts

SIMONDS

Inserted-Tooth METAL-CUTTING Saws

Curved-gullet design . . . together with alternating square and bevel teeth . . . prevents welding of chips to the saw-plate. Each tooth is held in place by its own separate wedge, which gives extra strength to the saw. And Simonds' own special high-speed steel gives greater speed, feed, and depth of cut. So for uninterrupted operation, get Simonds I. T. Metal Saws from your Industrial Supply Distributor, or from the nearest Simonds office.

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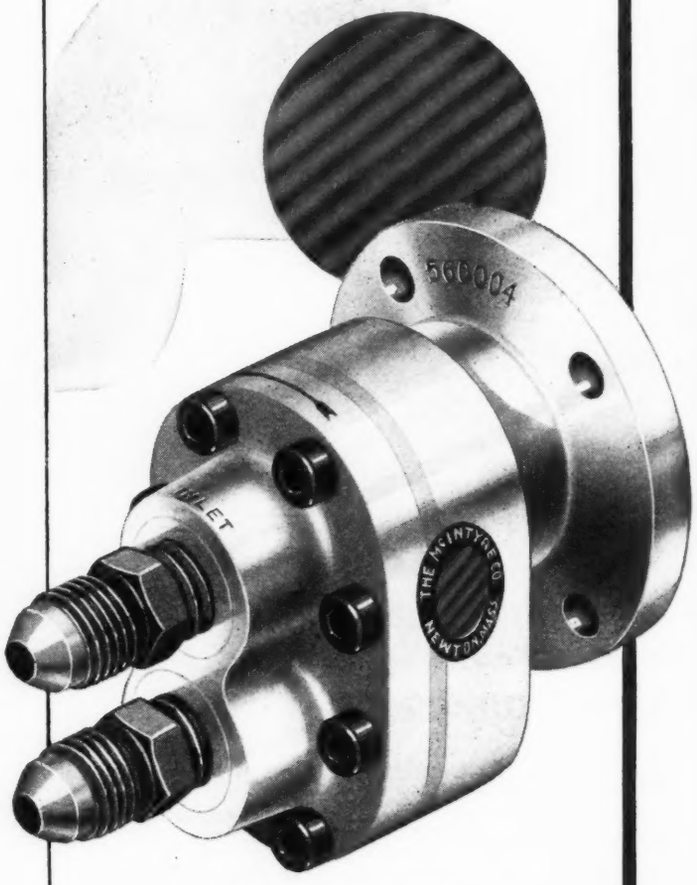
PRODUCTION TOOLS FOR CUTTING WOOD, METAL, PAPER, PLASTICS, ETC.

THIS PUMP WEIGHS ONLY 6 OZS.
...BUT SEE WHAT IT DOES

If small size, light weight and low cost are important factors in your pump applications calling for low-capacity, low-pressure handling of oils, gasoline, alcohol, and certain mildly corrosive liquids, investigate McIntyre Series 1200 Pumps. You'll find that they actually cost less than larger, heavier pumps made to less-exacting specifications.

Delivers .08 to 1.5 G.P.M.
. . . against 0 to 150 P.S.I.
. . . at 1140 to 3450 R.P.M.
. . for 2000 hrs. (continuous duty)



SCALE: ACTUAL SIZE
Available with 10,000 R.P.M. 1/20 H.P. Motor

McINTYRE PRECISION

Because McIntyre machining methods are *capable of making surfaces flat to one light band . . . and holding vital dimensions to tolerances of tenths and split tenths,* the close fit of gears, center plates and sides of McIntyre Pumps assures high volumetric efficiency. That is the plus the McIntyre light-band trade-mark promises.

WRITE FOR DATA

Whether you're interested in pressure lubrication of high-speed machinery, fluid handling in aircraft at high altitudes, or other possible applications, write for information about McIntyre Series 1200 Pumps, today. The McIntyre Company, 200 Riverdale Ave., Newton 58, Massachusetts . . .
also makers of precision spur gears to your specifications.

THE McINTYRE CO.
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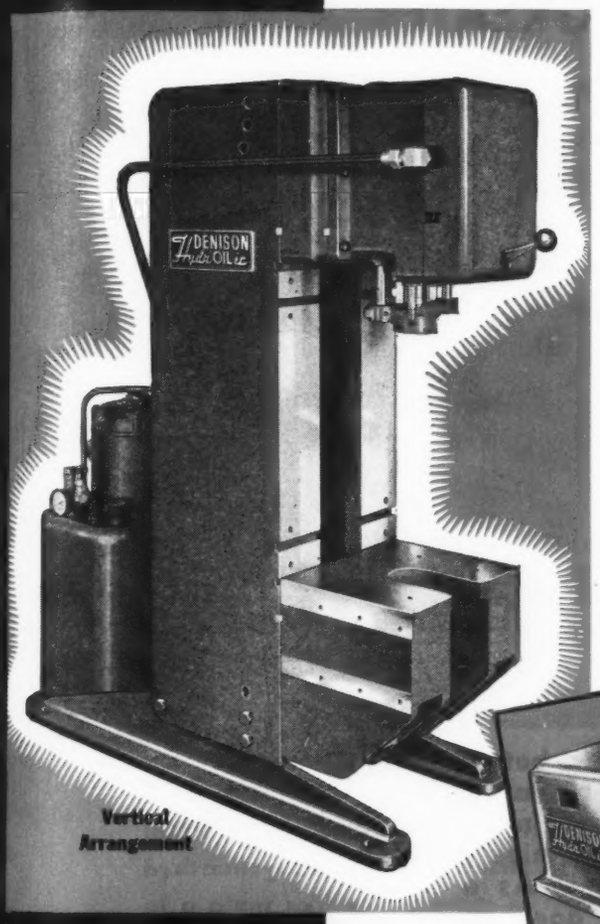
PUMPS AND FLUID MOTORS

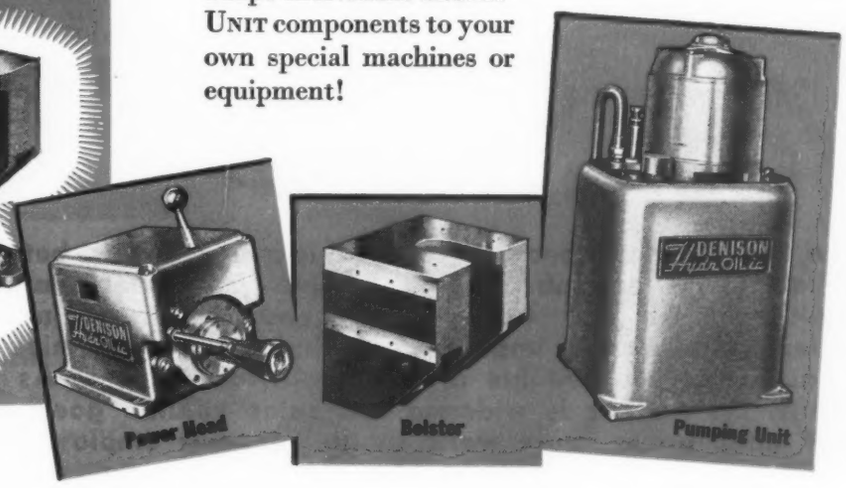
THE ULTIMATE IN PRECISION — *IDENTIFIED BY THE LIGHT BAND*

Radically NEW Design
MULTIPLIES PRESS FLEXIBILITY!



MULTI-UNIT Hydroilic PRESS

A news-making improvement in machine tool design! A Denison hydraulic press built in separate, self-contained, specially designed components that achieve two striking advantages! First, they combine into the highly flexible MULTI-UNIT press, which can be set up in a variety of ways to meet many different needs. Second, your engineers can quickly and economically adapt individual MULTI-UNIT components to your own special machines or equipment!



MULTI-UNITS include the Pumping Unit, Power Head, Standard Frame, and Bolster. The Power Head, available in seven models, offers an amazing variety of ram actions, including manual or automatic control, rapid traverse and regulative pressing speed, automatically repeated pressure strokes, automatic ram cycling, and the now-famous Vibratory HydrOILic Pressure. Ram pressures are closely limitable up to 4 or 6 tons. Ram strokes are regulative between 1/32 inch and 6 inches.

The Standard Frame is drilled and keyed to permit a variety of bolster and Power Head adjustments, and features a choice of legs and "feet" that adapt the press to four different positions—horizontal, vertical, and at 10 or 20 degree inclines. Standard interlocking accessories, such as indexing tables and ejection cylinders, are applicable to these Multi-Units.

Write today for full details on this sensationally new production aid!

The DENISON Engineering Co.
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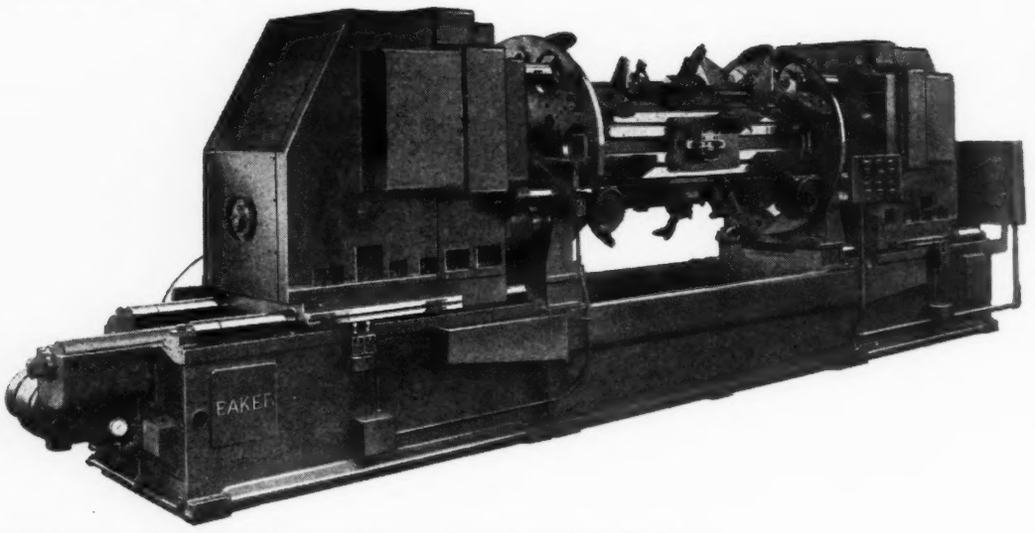
HydrOILics INDUSTRY'S RIGHT HAND

DENISON EQUIPMENT in APPLIED HydrOILics

Increased Productivity

—THE FIRST STEP TOWARD GREATER JOB SECURITY . . . BETTER JOBS . . . AND WIDER MARKETS



The soundest approach to the problem of creating better jobs is to make every job more productive. Does that sound paradoxical? Look at it this way: Markets, jobs and job security are all tied up together. When production is improved and increased, economies permit a manufacturer to sell his product at a lower price. As a result, his market is widened, his sales volume goes up . . . And that adds up to more work to do, steadier employment—and better jobs.

HERE'S THE WAY WE LOOK AT IT...

We do not build machines in order to subordinate or eliminate the human element. On the contrary, Baker machines are designed to aid each operator in increasing his productivity and improving the quality of his work . . . . with less effort.

Baker unit type machines provide an answer to the metal-working industry's production—and job-problems. For example, the machine shown above is designed to increase productivity on a very large part; in this case, a truck rear axle housing. Five operations are performed simultaneously — facing, chamfering, hollow milling, arc drilling and step core drilling—and one completed housing is produced at each machine cycle. This machine is 287 inches long and 80-1/4" high from floor to top of head unit, yet it is easy to operate through the pushbutton electric cycle control. Machine can be furnished with hand or power automatic index trunnion fixture. Exceptional rigidity permits use of maximum feeds and speeds. Saddle, mounted on nitralloy bars, maintains accurate alignment and is free from wear.

Whatever your machining problems, get Baker recommendations for efficient, unit-type machines that will give you all the benefits that result from increased productivity.

BAKER BROS., Inc., TOLEDO 10, OHIO

PRESSURE-TIGHT FLEXIBILITY for 350-lbs. Hydraulic Pressure

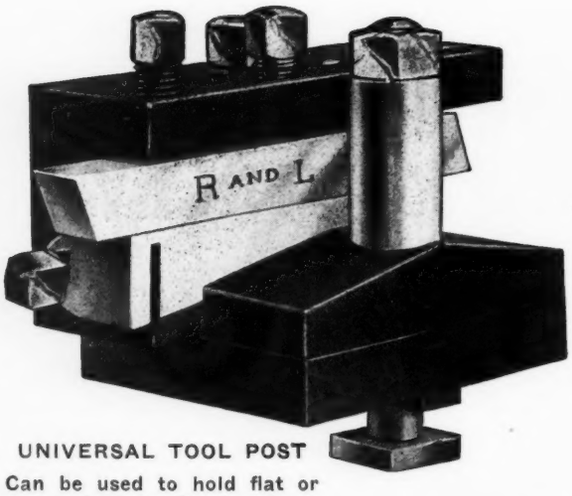
Here you see Titeflex all-metal, flexible tubing delivering up to 350-lbs. hydraulic pressure to the business end of a giant milling machine. Installed in the hydraulic mechanism which imparts both vertical and horizontal movement to the cutting head, Titeflex has the inherent tightness and flexibility to withstand surging pressure . . . constant flexing.

Similarly, Titeflex gives the same trouble-free performance in no end of applications calling for the conveyance of gases and liquids under extreme temperatures, continued vibration, and corrosive attack.

Investigate now the increased operating efficiency and economies which accrue from the use of Titeflex. Our application engineers stand ready to work with you on any specific installation problem. Titeflex, Inc., 519 Frelinghuysen Avenue, Newark, New Jersey.

Titeflex

THE ALL-METAL FLEXIBLE TUBING THAT STAYS TIGHT



UNIVERSAL TOOL POST

Can be used to hold flat or square tools on front or back cross slide with the spindle running either direction.

R AND L TURNING TOOL

Shown set up for drilling, turning and burnishing. The Tantalum Carbide backrest may be removed and the new Roller Backrest, shown below, substituted.

RIGHT R AND LEFT L

INCREASES MACHINE CAPACITY—QUICKLY!

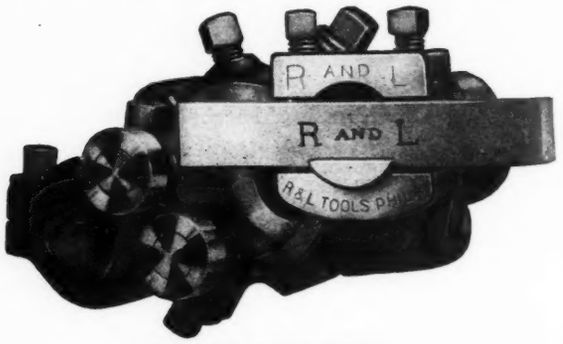
Make one turret do the work of two—or three, with the R and L Turning Tool. Make one tool post serve for dozens of different turning jobs. Use a Tap and Die Holder that operates equally well on right or left hand threads. R and L offers these quick ways of increasing machine capacity, of speeding up operations, of simplifying tool maintenance and inventory. The entire line of R and L Tools is built to reduce set-up and operating time. The Turning Tool can be set up to perform two or three simultaneous operations, such as drilling, turning and burnishing. The Universal Tool Post is ruggedly built, designed to hold square or flat tools on the front or back cross slide with spindle running either direction. The Tap and Die Holder has a simplified and more positive releasing and engaging mechanism that eliminates wear. All are designed for service, ruggedly built of selected materials. With them you can increase machine capacity, save in first cost, set-up and operation time, and maintenance. Write for R and L Booklet giving full details.

R AND L TOOLS

1825 BRISTOL STREET, Nicetown, Philadelphia, Pa.

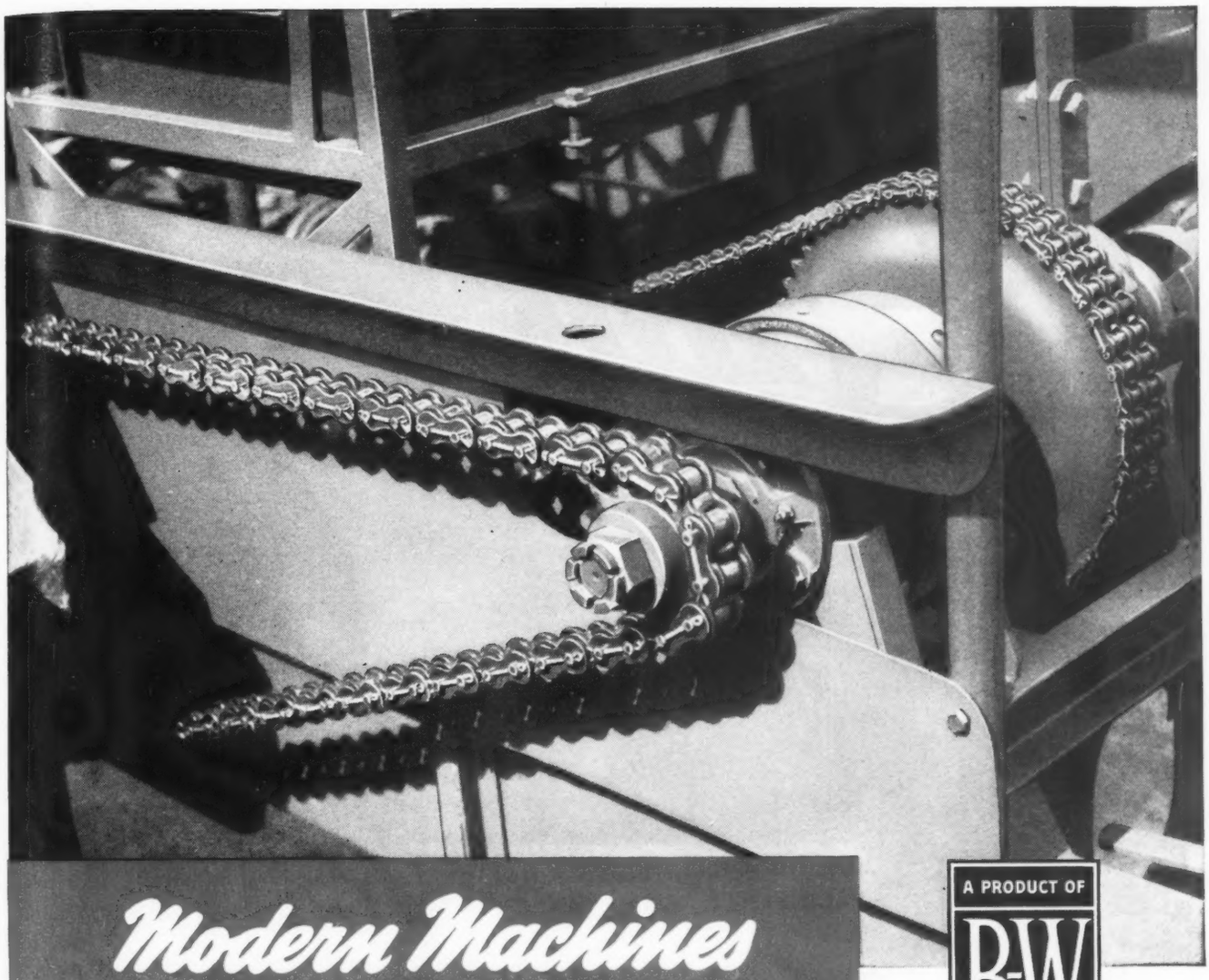
TAP AND DIE HOLDER

New design eliminates spring plungers and small screws. Engaging teeth separate fully—and instantly—when released, eliminating wear.



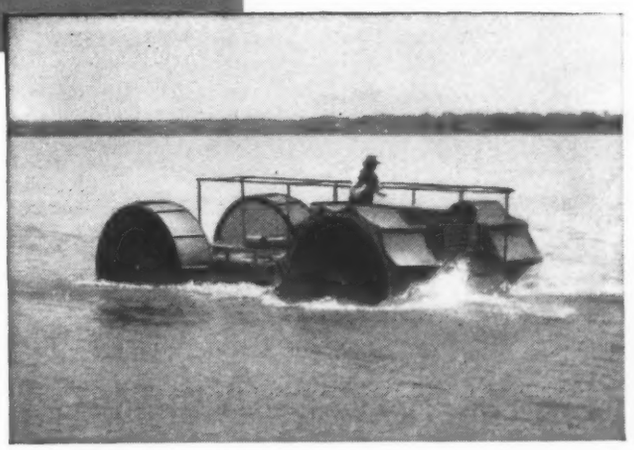
ROLLER BACKREST

Made in five sizes to fit the five sizes of R and L Turning Tools. Easily set up for either right or left hand turning.



Modern Machines Deserve Morse Drives...

A PRODUCT OF B-W BORG-WARNER



Ironcraft's Floating Marsh Buggy "goes anywhere", and is widely used for oil exploration. Equipped with Morse No. D60 Roller Chain and No. 100 Roller Chain, using teeth not tension, it obtains positive drive under the toughest going. MORSE CHAIN COMPANY, ITHACA, N. Y., DETROIT 8, MICH.

MORSE ROLLER and SILENT CHAINS

SPROCKETS • FLEXIBLE COUPLINGS • CLUTCHES

UNION CHUCKS

The broadest line of Chucks in the world

The right chuck for the job is a large factor in the popularity of Union Chucks. Another factor is contributed by our foundry where quality controlled castings are made. This helps us give you better chucks — when you want them. Our complete engineering service is available to help you with your choice.

UNION MANUFACTURING CO.
New Britain, Conn.
U. S. A.

There's a LODGE & SHIPLEY LATHE for

1 PIECE ... 12" TO 25"

ENGINE LATHES You can't beat these Engine Lathes for general utility on single piece jobs. They're built with extra rigidity, take heavy hogging cuts without vibration. As a result, you can demand more from these lathes and get it—in much less time. Write on your company letterhead for detailed literature No. 500, 503, 605.

25 PIECES ... 12" TO 25"

MANUFACTURING LATHES give you remarkable time savings on repetitive work in large or small lots. Manufacturing attachments form a profitable production unit. These permit multiple tooling and easy, rapid duplication of lengths and diameters. An L & S Manufacturing Lathe need never be idle—it's an engine lathe for single piece jobs, rivals an automatic on production work. Write for detailed literature No. 608, 615

25,000 PIECES

2A OR 3A DUOMATICS are fully automatic, even on complex multiple tool jobs. So easy, any unskilled operator can handle one or more of these lathes. You just put in the workpiece, start the cycle, take the piece out when finished. It's like two lathes in one, with front and rear carriages and tool slides, operated singly or together. A Duomatic turns thousands of pieces with amazing savings in time and effort. The 2A is for small jobs, the 3A for larger work. Write for detailed literature No. 601 and 620.

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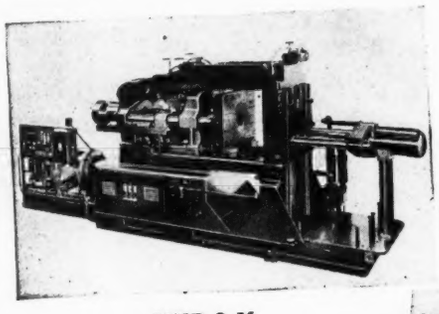
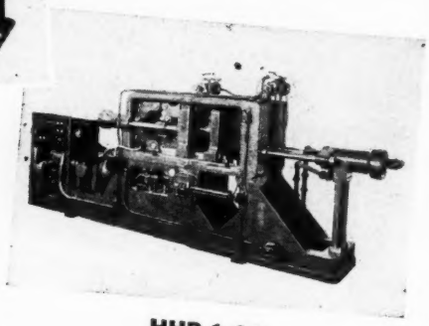
L & S LATHES

DIECASTING DIGEST

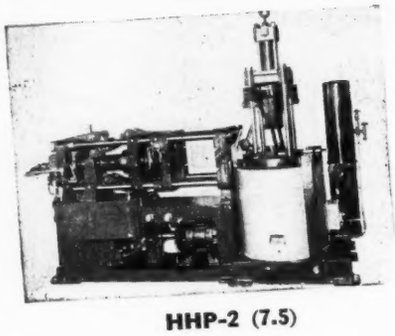
XI—Selecting the Machine to Suit the Job.



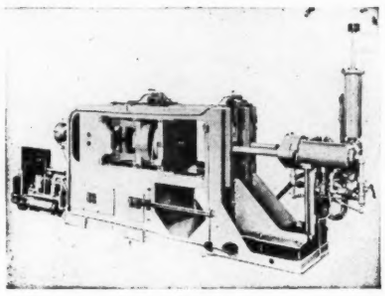
HHP-3-X



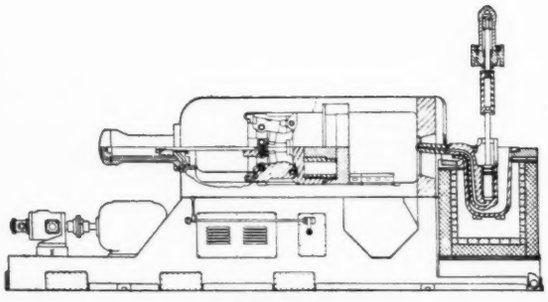
HHP-1-CC



HHP-2 (7.5)



HP-3½-X-SF



HP-2-SF

A very important factor in die casting is selecting equipment correctly rated for the job. To try to make castings which are too large or too heavy for the injection capacity and the die locking pressure of the machine employed, is a serious error. Such procedure can result only in imperfect castings, with high porosity and poor dimensional accuracy. The purchase of a machine too large for the production of small castings, is equally impractical, unless such castings are required in sufficient quantities to use large multiple cavity dies, advantageously.

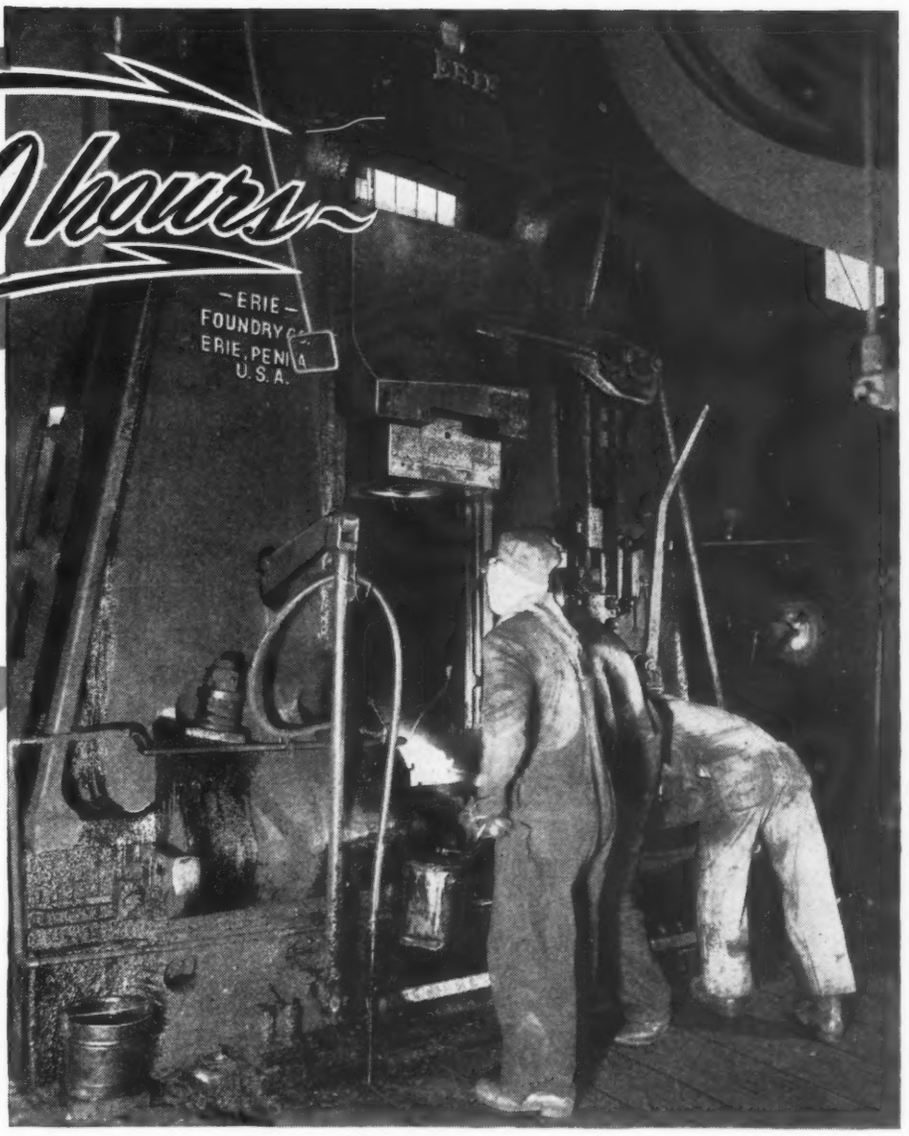
Lester-Phoenix Die Casting Machines are made in five models in each of two types, one with submerged plunger injection for low melting point alloys such as lead, tin and zinc, the other with cold chamber "slow squeeze" injection system for aluminum, brass and magnesium, thereby providing a complete range of sizes from the HHP-2 (7.5) and HHP-1 CC for smaller zinc and aluminum castings, to the large HP-3½-X-SF, for aluminum castings up to 14 pounds, and the HP-3½-SF for zinc castings up to 19 pounds. Each one shown is a highly developed high production machine for its specific range; each is readily convertible from the one type to the other.

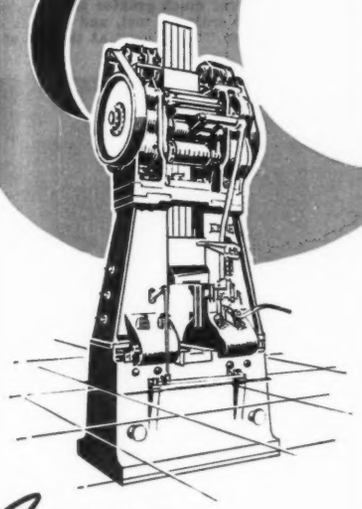
Except for the HHP-2 (7.5) and the HHP-2 CC, which have bar type frames, all Lester-Phoenix machines have either the well-known four piece beam type cast steel frames or the new one-piece solid cast steel frames which eliminate all joints and fitting and provide the strongest, most rugged frame possible. Die plates are adequately supported, high final "slow squeeze" injection pressure (up to 33,000 psi on aluminum) can be applied and held on the castings as they chill in the die, thereby limiting and controlling porosity, producing sound, smooth castings.

All machines have fast acting, positive closing toggle linkage for die movement; rapid die height adjustment is by a single hand crank; dies are positively and adequately supported and remain parallel, thereby producing better castings faster, at lower cost, including maintenance cost.

For complete information on these and other exclusive Lester-Phoenix features, including full data on the patented Lester Pre-Fill injection system for aluminum, brass and magnesium casting, write Lester-Phoenix, Inc., 2641 Church Avenue, Cleveland 13, Ohio.

Over 100 hours—





Over 100 hours

BOARD LIFE on 7500 Lb. and 6000 Lb.

Erie Board Drop Hammers . . .

POSITIVELY equalized pressures between rolls and boards at all times results in longer hammer board life.

Recent reports from a large user of Erie Board Drop Hammers state that "the 2½ inch thick hammer boards in our 7500 lb. Erie hammers are run about 56 hours . . . then we have them dressed down to 2 inch thickness and get an additional 48 to 56 hours on these same boards in our 6000 lb. hammers".

By the application of a simple mechanical principle, the pressures between rolls and boards are kept exactly equalized even though boards might be tapered or have grooves across them. Rolls cannot drag on the boards when the ram is dropping on Erie Board Drop Hammers.

Complete description of Erie Board Drop Hammers is given in bulletin 339 . . . with further details on head construction page 22. *Write for this bulletin today.*

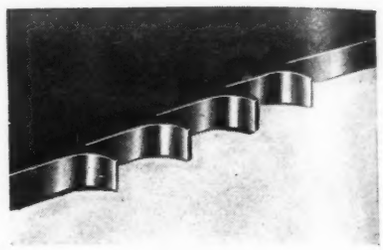
ERIE

ERIE FOUNDRY COMPANY
ERIE, PA.

ERIE BUILDS *Dependable* HAMMERS

ARMSTRONG

SYSTEM OF TOOL HOLDERS



As each chip is comparatively light, a planer will, with this tool, carry with ease a feed and depth of cut much greater than is possible when using an ordinary tool, and there is much less tendency to "break out" at the end of cut.

Doubles (even triples) Planer Production

The ARMSTRONG Gang Planer Tool not only ends costly delays for "tooling-up", it actually reduces planing time as much as 75% — multiplying machining profits proportionally. It is the correct tool for planing large surfaces. Carrying 4 square cutter bits, this tool makes not one but four cuts with each traverse of the bed. The head of this tool swivels and is graduated so that it can be quickly and accurately set to any desired feed.

The Armstrong System of Tool Holders provides the correct tools for every operation on lathes, planers, slotters and shapers. Each is an efficient profit-building tool — a permanent multi-purpose ARMSTRONG TOOL HOLDER that "Saves: All Forging, 70% Grinding and 90% High Speed Steel". Your industrial distributor has them in stock.

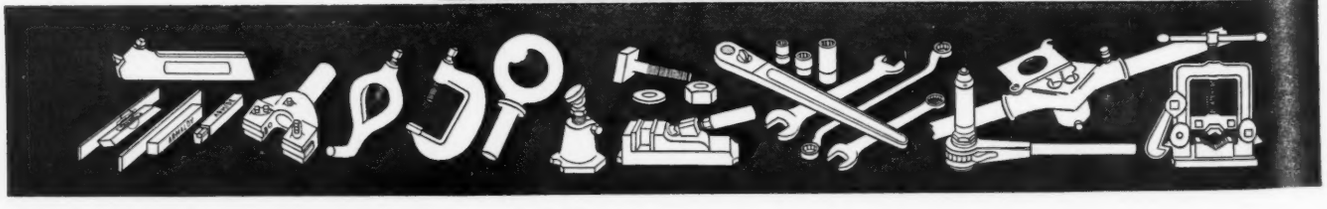
ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

313 N. Francisco Ave., Chicago 12, U. S. A.

Eastern Whse. and Sales:
199 LAFAYETTE ST., NEW YORK 12, N. Y.

Pacific Coast Whse. and Sales Office:
1275 MISSION ST., SAN FRANCISCO 3, CALIF.

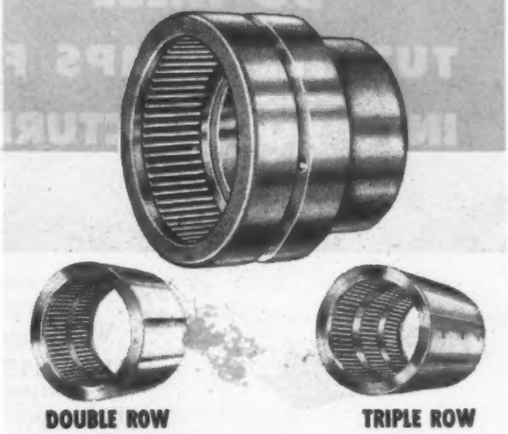


Smooth Running Under Heavy Loads!

The Giant Drive Screw of NILES 36 ft. Plate Planers runs on

This huge machine planes or scarfs the edges of ship sides or deck plates. Armor plate 16 inches thick has been machined on these Niles Plate Planers. Some idea of the forces involved may be gained from the fact that the approximately 55 foot long drive screw rotates at 300 r.p.m. Three double-row Orange Roller Bushings and two Orange Thrust Bearings used on the end mountings, provide smooth frictionless operation.

ORANGE ROLLER BUSHINGS



DOUBLE ROW TRIPLE ROW

Where loads are too heavy for single-row bushings, the double-row bushings are preferable to two single adjacent units. In severe applications, the triple-row assembly is preferable to three adjacent single units. Supplied in standard or special sizes.

WHEREVER precision running, combined with heavy load, is required in your equipment—install Orange Roller Bushings. Their smooth, even running is due to their basic design and high standards of precision manufacture. Roller clearances are held to a minimum—resulting in closer running clearances, which maintains true alignment between the rollers and the highly finished raceways.

Give your product longer life and smoother performance with Orange Roller Bushings. Available in a full range of sizes and types for most requirements. Send coupon for Engineering Data Book showing designs, sizes, capacities, installation data, etc.

ORANGE ROLLER BEARING CO., INC.
552 Main Street, Orange, N. J.

Mail Coupon for Engineering Data

Orange Roller Bearing Co., Inc., M
Orange, N. J.

Please send me your Roller Bushing Data Book.

Name.....Title.....

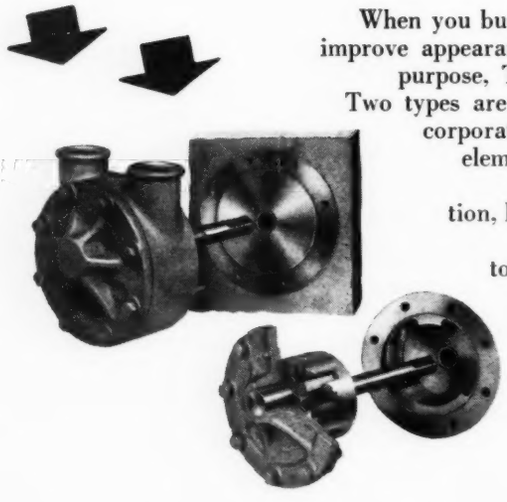
Company.....

Address.....

City.....State.....

Courtesy of
Western Gear Works

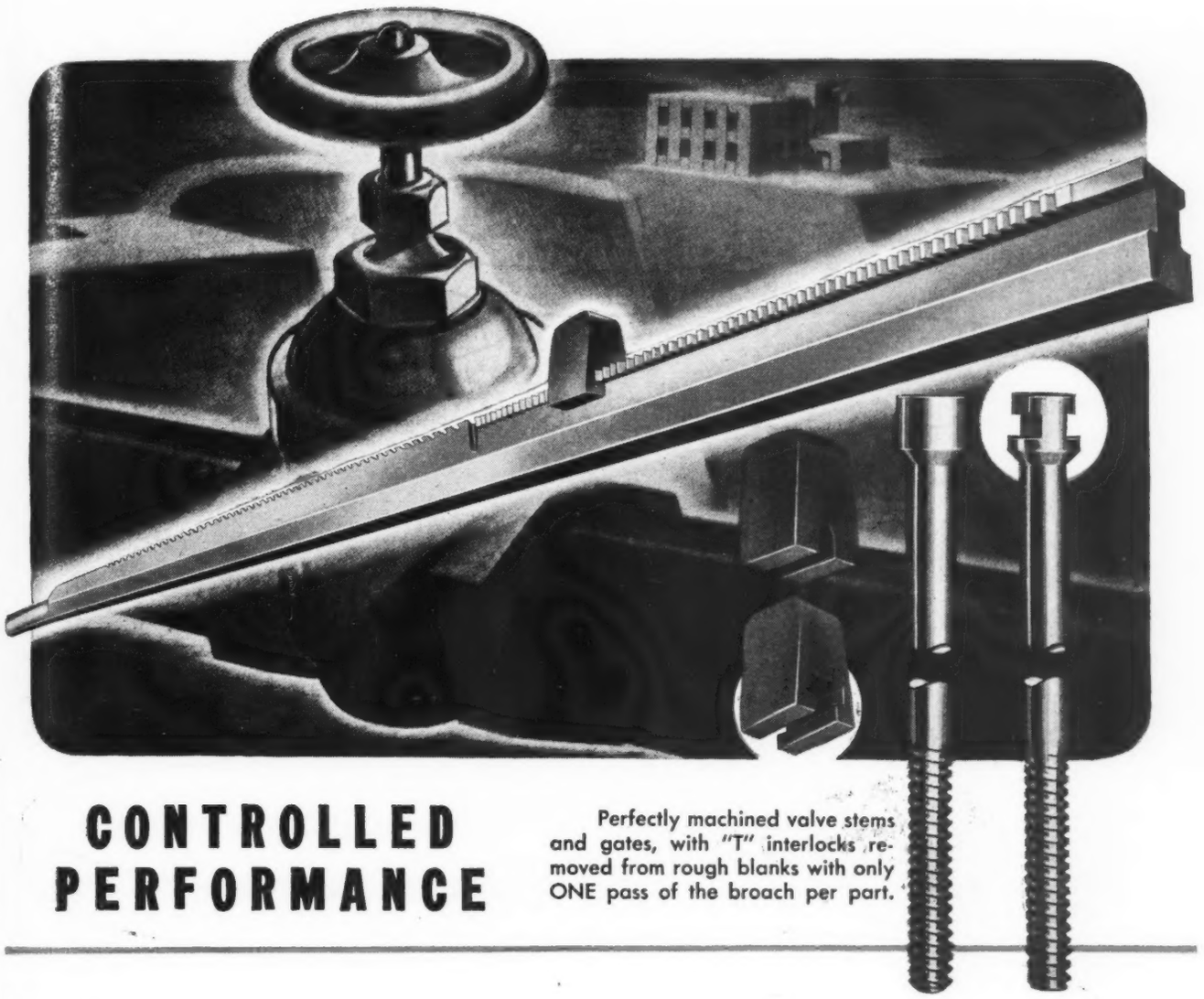
DO THESE TUTHILL PUMPS FIT INTO YOUR PICTURE?



When you build the pump directly into the design of your machine, you not only improve appearance, but you also save time, space, material and money. For this purpose, Tuthill supplies stripped pumps that effect these important savings. Two types are available. One offers the pump without mounting bracket as incorporated in the machine above. The other type consists of the pumping elements only which can be assembled in your special housing to meet your porting requirements. Applications include coolant, lubrication, hydraulic and liquid transfer service. Capacities from 1 to 50 g.p.m. Also furnished in automatic reversing types. It will pay you to check up and see whether these Tuthill pumps fit into your picture. Write for Stripped Pump bulletin.

TUTHILL

TUTHILL PUMP COMPANY • 939 EAST 95TH STREET • CHICAGO 19, ILLINOIS



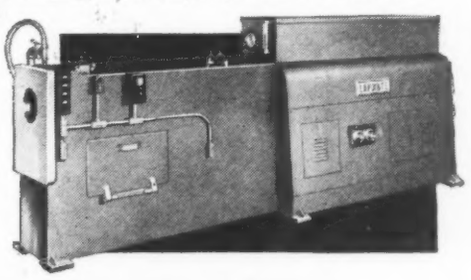
CONTROLLED PERFORMANCE

Perfectly machined valve stems and gates, with "T" interlocks removed from rough blanks with only ONE pass of the broach per part.

Firm in the knowledge that their business was primarily that of producing control elements for industry, a prominent manufacturer sought a means of achieving increased production of valve components —provided commensurate or better control of quality could be achieved without increasing floor space or labor costs. Who wouldn't? Lapointe provided the answer with specially designed fixtures and broaches, fitted to a standard Lapointe broaching machine. Maintaining absolute consistency, this equipment out-performs the original method at a ratio of nearly 3½-1 . . . at a rate of 120 parts per hour.

Such performance is no isolated instance. Increasing numbers of progressive manufacturers have turned to Lapointe for the answer to their demand for speedy, economical production of precision parts. Pioneers in the development of broaching tools and methods, Lapointe engineers will prove that by the use of broaching, you, too, can produce hairline tolerances, and at rock-bottom cost!

HP-100, Horizontal Broaching Machine. One of many versatile machines, ranging in pull capacity from 3 to 100 tons.

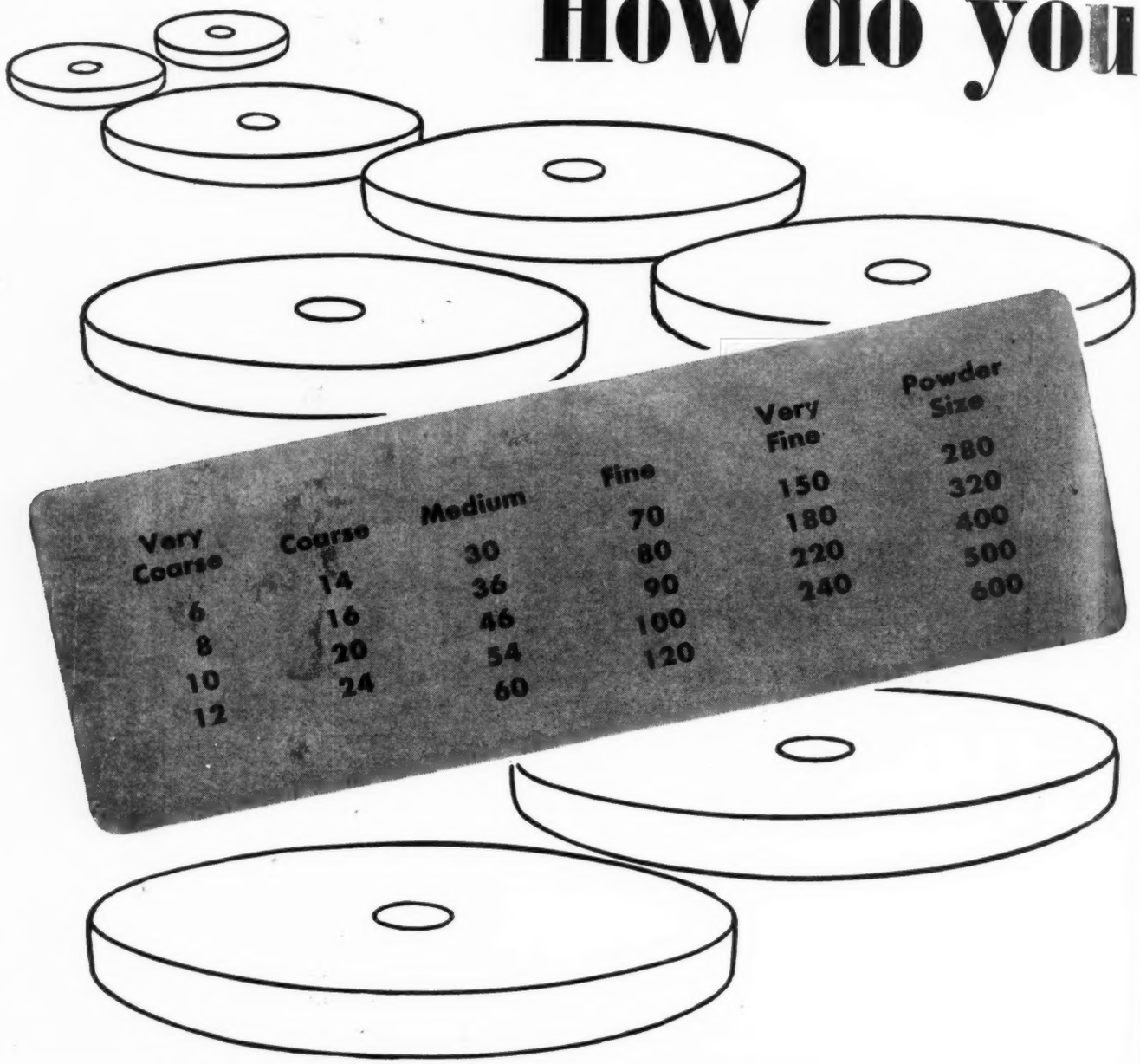


THE Lapointe MACHINE TOOL COMPANY

HUDSON. MASSACHUSETTS • U.S.A.

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES

How do you



A good rule for good grinding... **CALL**

tell which grit to use?

Listed is a commercial classification of standard abrasive grit sizes. They come in a wide range... from 6 classified as very coarse to 600 classified as powder size. And, the variety is further extended by special sizes and combinations. Yet, each one is designed to do a specific job better than any of the rest.

To complicate correct choice even more, there is a long list of variable factors to consider. Among these, you'll find wheel speed, machine condition, specified tolerances, material analysis, related production schedules, and a host of others.

The correct selection hinges on the review which is given to all the controlling factors. Yet... grinding efficiency and economy depend on the right answer.

That's why The Carborundum Company has put together a practical program...a service now deemed essential by many concerns who have been successful in getting improved grinding in terms of better finishes, or at lower cost.

Your nearest contact to this effective service is a CARBORUNDUM representative. You'll find him willing and helpful. Through a sound knowledge of abrasives and first-hand experience of their use and application in the many plants he contacts, he is able to make intelligent recommendations and suggestions. On the more uncommon problems, he can even call on our Abrasive Engineers who are more fully qualified to tackle the tough problems. And, sometimes, the answer comes from the modern laboratories at CARBORUNDUM—where scientists and technicians probe for new information on abrasives, practices and developments.

Here is a sound approach—not only to getting the right grit—but the right combination of grit, bond, grade, structure and all the other parts that make up a grinding wheel. *Plus* knowledge and experience invaluable in modern grinding methods and procedures. It's easy to use. It incurs no obligation. It always makes sense. The Carborundum Company, Niagara Falls, N. Y.

IN CARBORUNDUM

TRADE | MARK

BONDED ABRASIVES

WHEELS
- Silicon Carbide
- Aluminum Oxide
- Diamond

Cylinder Hones
Sticks, Stones & Rubs
Specialties

COATED ABRASIVES

Paper, Cloth and Combination
Sheets, Rolls, Discs

ABRASIVE GRAINS AND COMPOUNDS

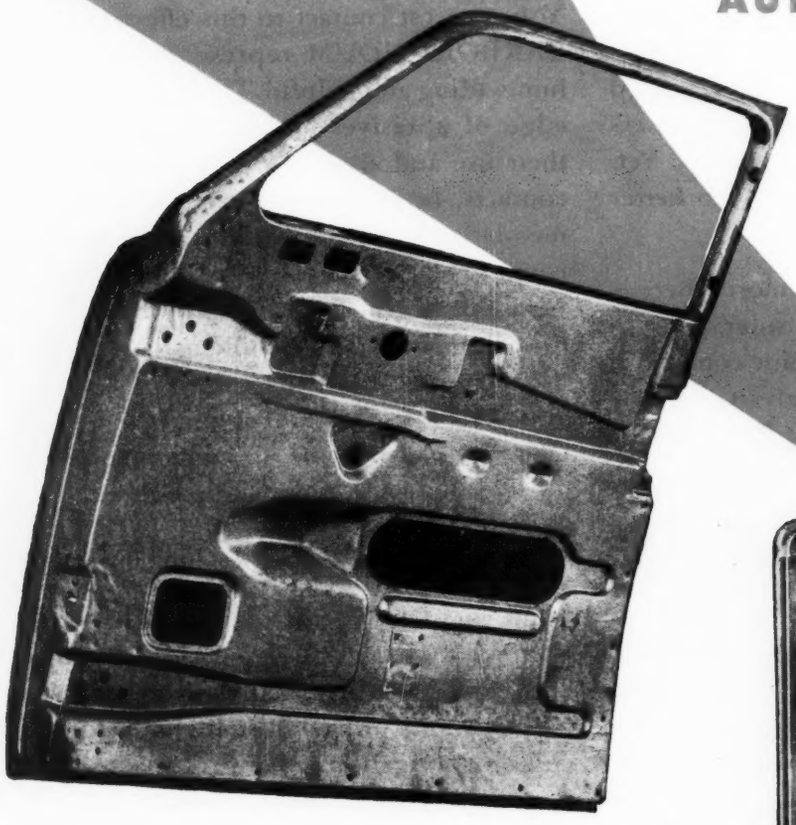
for:
Polishing
Lapping
Pressure Blasting
Finishing

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company

NOTICE Who Uses

Automotive Industry

welds complete steel doors in one whack.



Refrigeration Manufacturers

weld steel cabinets ten times faster than old methods.

Radio and Instrument Makers

weld three parts of tube at once . . . 2,500 per hour.

MEMBER RESISTANCE WELDER MANUFACTURERS ASSOCIATION • RWMA

THE Federal MACHINE

SUBSIDIARIES

Sommer and Adams Co., Cleveland—SPECIAL HIGH PRECISION MACHINES

The Warren City Mfg. Co., Warren—HEAVY WELDMENT-HEAVY MACHINERY

Federal

AUTOMATIC WELDING

It is significant that metal fabricating industries noted for producing the most goods at lowest unit cost are the largest users of automatic resistance welding . . . also that Federal welders fill the "lion's share" of such applications.

Nowhere are production costs more critically scrutinized than in the automotive industry—which uses and *continues to order* more Federal Resistance Welders than any other group. One reason is the sort of production illustrated at left. Two full-door-size stampings are welded into permanent union in a single pass through one of the latest machines developed by Federal in collaboration with designers of the door itself. Refrigeration, radio and instrument makers follow this lead for the same reason—that fabricating costs are cut by Federal.

Not all of these applications call for special machines. There is a wide variety of basic types in the Federal welder line. Infinite variations of each are available with simple adaptations. Whatever YOU make in metal, it makes sense for you to study the practical reasons why the big timers, and others as well, turn more and more to *fabrication with Federal Resistance Welding*. It pays to do this *before* your product design is completed.

Get a copy of Federal Bulletin SP 346, which briefly describes each of the basic welder types. Then let a Federal Engineer prove to you that the best production welding is by

Federal

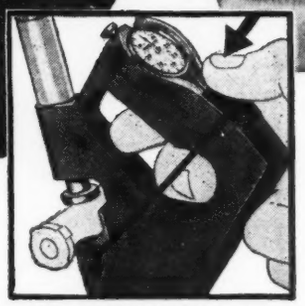
GET THIS BULLETIN
describing all of the basic types of Federal Resistance Welders.

AND WELDER COMPANY

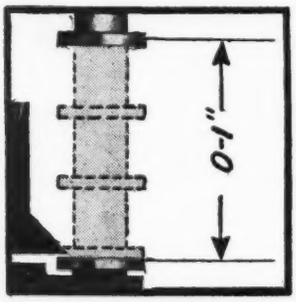
208 DANA STREET • WARREN, OHIO

Why Not SEE Rather than feel

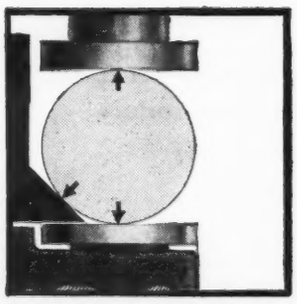
Weight of Gage and operator's hand rests upon the fixed contact. Gage is only ⅝" wide.



A light thumb pressure retracts the sensitive contact. Work surface is not marred. The contact movement is transferred direct to Indicator.



The upper or reference contact is adjustable to any dimension within one inch.



Backstop locates work in center of contacts and is adjustable for size.

FEDERAL INDICATOR SNAP GAGE *with-Retractable Anvil Adjustable for Size No Lost Motion*

This Model 1330 P-100 Visual Dial Indicator Snap Gage marks a decided step ahead in gaging practice. Conventional type, fixed or solid snap gages depend upon "feeling", and personal variations in the sense of touch influence the inspection accuracy. But, you **see** with this.

The Model 1330 P-100 has other advantages too — **The retractable anvil** makes it easier to apply, and it eliminates all excuses for marring the surface of highly finished workpieces. **It is easily adjusted** to any dimension within one inch and locked in place. **There is no lost motion.** The movement of the sensitive contact is transferred directly without error to the Dial Indicator. **The weight of the Gage and the inspector's hand rests upon the fixed or reference contact. It is thin:** only ⅝". It is small; not over 6" at the longest point. It is light; weighs only 15 ozs. It reads in tenths (.0001"). Contacts are hard wearing Norbide (Made by Norton Co.) For more details concerning this modern snap gage write

FEDERAL PRODUCTS CORPORATION
1144 EDDY STREET PROVIDENCE 1, R. I.

★ ★ ★ ★ ★ **FEDERAL** ★ ★ ★ ★ ★

PRECISION MEASURING INSTRUMENTS

HIT THE BULL'S-EYE with Ettco-Emrick

TAPPING ATTACHMENTS

The aim of all tapping is high production at low cost. With a relatively inexpensive Ettco-Emrick Tapping Attachment on the spindle of your drill press, you can hit this bull's-eye every time. Not only are your initial costs low, but you save on labor and production costs — because even inexperienced operators can tap fast and accurately with Ettco-Emrick Tapping Attachments. . . . Tapping skill is built into these attachments by exclusive Ettco-Emrick design and construction features. They give full protection against work spoilage and broken taps.

BULLETIN NO. 2 gives full details.
Write for a copy.

TOP PRODUCTION AT LOW COST

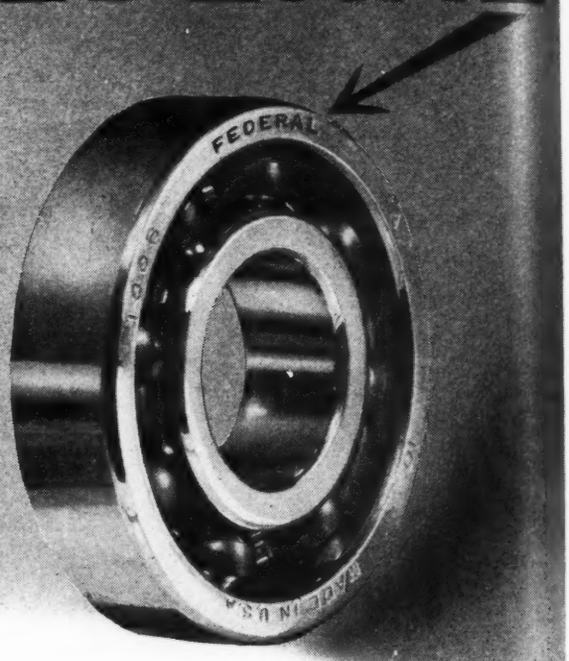
ETTCO TOOL CO.

592 Johnson Ave., Brooklyn 6, N. Y.

DETROIT 1 CHICAGO 6

Over 25 years specialization in solving Industry's drilling and tapping problems

The Name FEDERAL Is Your Guarantee



•

The Federal reputation for Quality is known and recognized wherever ball bearings are used. Industrial designers, engineers and manufacturers who demand the best, specify Federal ball bearings for plants and products.

•

Beginning with the choice of steels and continuing on through every step in production, these fine ball bearings are made with painstaking care.

•

That is why we say the name "FEDERAL" is your guarantee . . . a guarantee of ball bearing strength, endurance and precision performance . . . at all times, under any conditions.

•

FEDERAL
BALL BEARINGS

THE JEWELS OF INDUSTRY

THE FEDERAL BEARINGS CO., INC.

Makers of Fine Ball Bearings

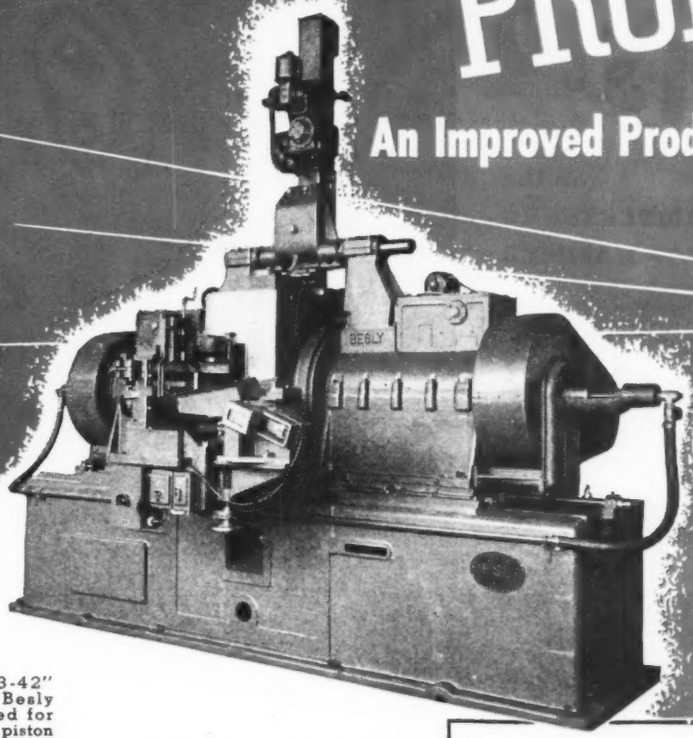
POUGHKEEPSIE, N. Y.

REPRESENTATIVES LOCATED AT

Detroit: 2640 Book Tower—26 • Cleveland: 402 Swetland Building—15
Chicago: 8 S. Michigan Ave.—3 • Los Angeles: 5410 Wilshire Blvd.—36

MAINTAINING PROFITS...

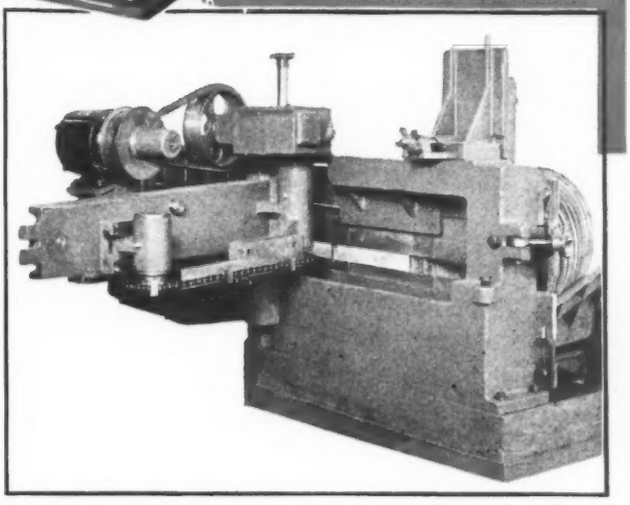
An Improved Product Now Costs Less



BESLY GRINDERS

● *Above:* No. "253-42" Double Spindle Besly Grinder equipped for grinding cast iron piston rings. This is used with chain feeder and vibrator-operated trough.

● *At Right:* Chain feeder. Note accessibility of feeding chains and ease of adjustment for rings of different diameters. Vibrator trough appears at extreme right.



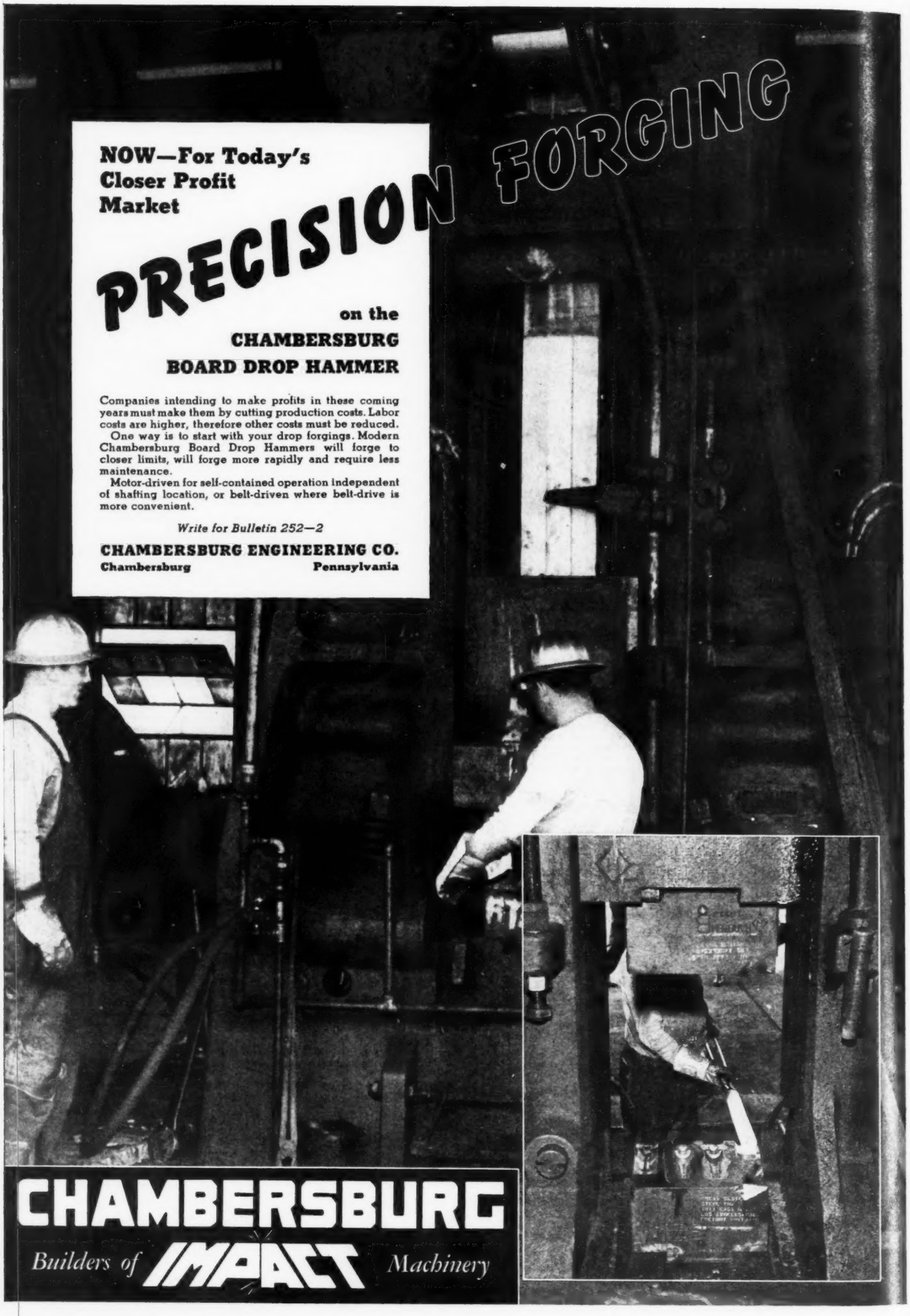
Accuracy previously considered impossible in high speed grinding is now achieved with this Besly Grinder—due to great rigidity and larger grinding members. For instance, on automotive size piston rings, a "253-42" Besly Grinder attains a speed of 500 passes a minute. In spite of this high rate, rings are held within .0003 for size, flatness and parallelism—with a 10 to 12 micro-inch finish. Oil is used as a coolant. Power truing device employs either diamonds or cutters. Grinding wheel adjustments are quickly and easily made with conveniently located push button controls.

Besly engineers are ready to discuss with you the many possible applications of highly-specialized Besly Grinders to the improvement in your product and the reduction of manufacturing costs. Write us today!

If you are considering a BESLY GRINDER from U. S. Government Surplus Stocks...
Ask us to help you select and adapt such machines to meet the specific needs of your production. Many of these machines were originally *specials* and are not suitable for general work.

BESLY BESLY GRINDERS AND ACCESSORIES
BESLY TAPS • BESLY TITAN ABRASIVE WHEELS

CHARLES H. BESLY AND COMPANY, 118-124 N. Clinton St., Chicago 6, Ill. • Factory: Beloit, Wis.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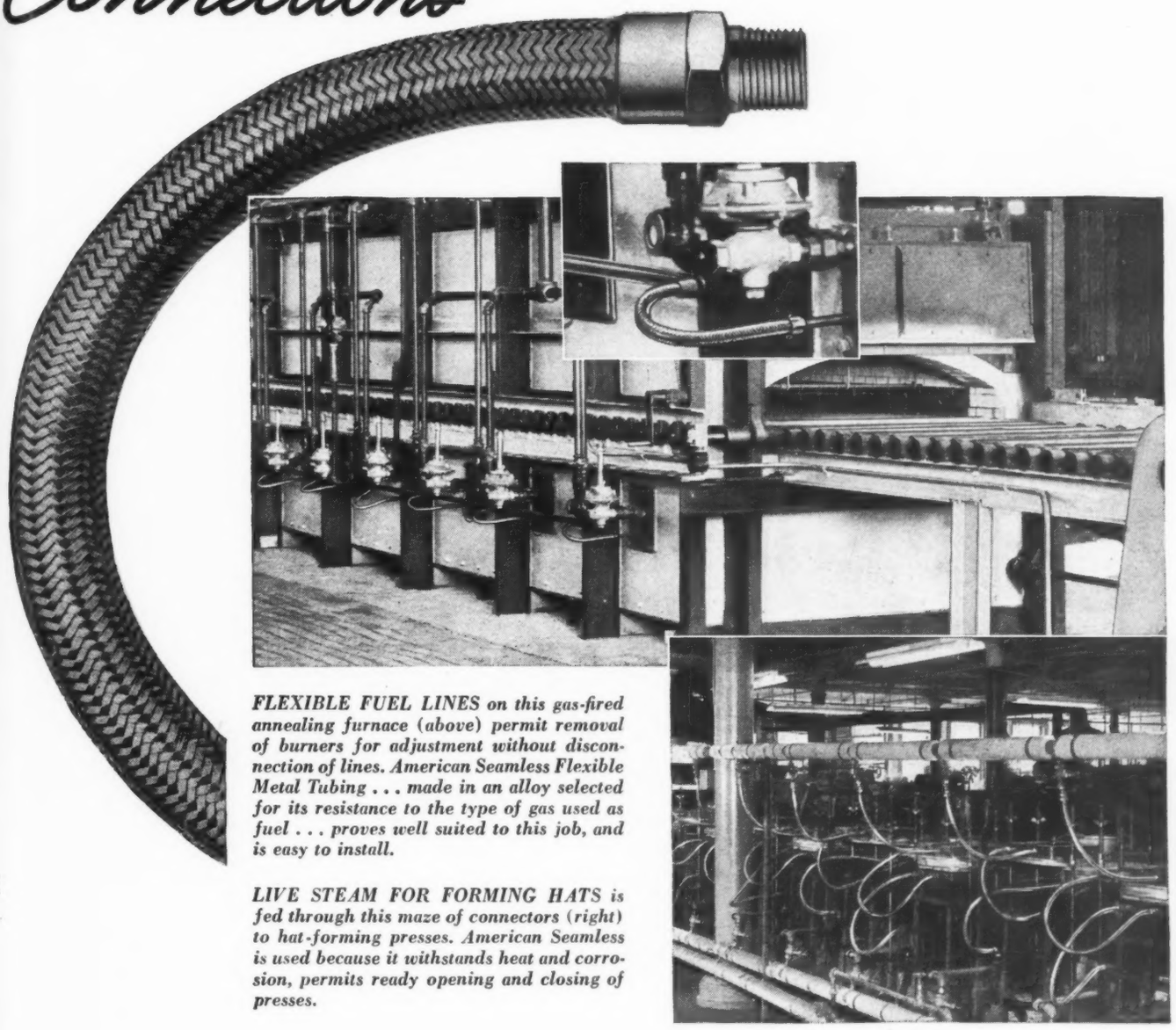
Closer Profit
Market
PRECISION FORGING
on the
CHAMBERSBURG
BOARD DROP HAMMER
Companies intending to make profits in these coming years must make them by cutting production costs. Labor costs are higher, therefore other costs must be reduced.
One way is to start with your drop forgings. Modern Chambersburg Board Drop Hammers will forge to closer limits, will forge more rapidly and require less maintenance.
Motor-driven for self-contained operation independent of shafting location, or belt-driven where belt-drive is more convenient.
Write for Bulletin 252—2
CHAMBERSBURG ENGINEERING CO.
Chambersburg Pennsylvania
CHAMBERSBURG
Builders of IMPACT Machinery

Flexible Connections to FURNACE and PRESS



FLEXIBLE FUEL LINES on this gas-fired annealing furnace (above) permit removal of burners for adjustment without disconnection of lines. American Seamless Flexible Metal Tubing . . . made in an alloy selected for its resistance to the type of gas used as fuel . . . proves well suited to this job, and is easy to install.

LIVE STEAM FOR FORMING HATS is fed through this maze of connectors (right) to hat-forming presses. American Seamless is used because it withstands heat and corrosion, permits ready opening and closing of presses.

HEAT, vibration, pressure, movement, abrasion or corrosion may very well raise havoc with the type of flexible connections you now employ. If so, look into the possibility of doing a better, safer, more economical job . . . with American Flexible Metal Hose or Seamless Flexible Metal Tubing.

Specially engineered assemblies of these durable products have solved serious problems for countless other manufacturers. The applications illustrated are typical. For detailed information, write for Publication SS-50.

40348

ANACONDA

American

METAL HOSE

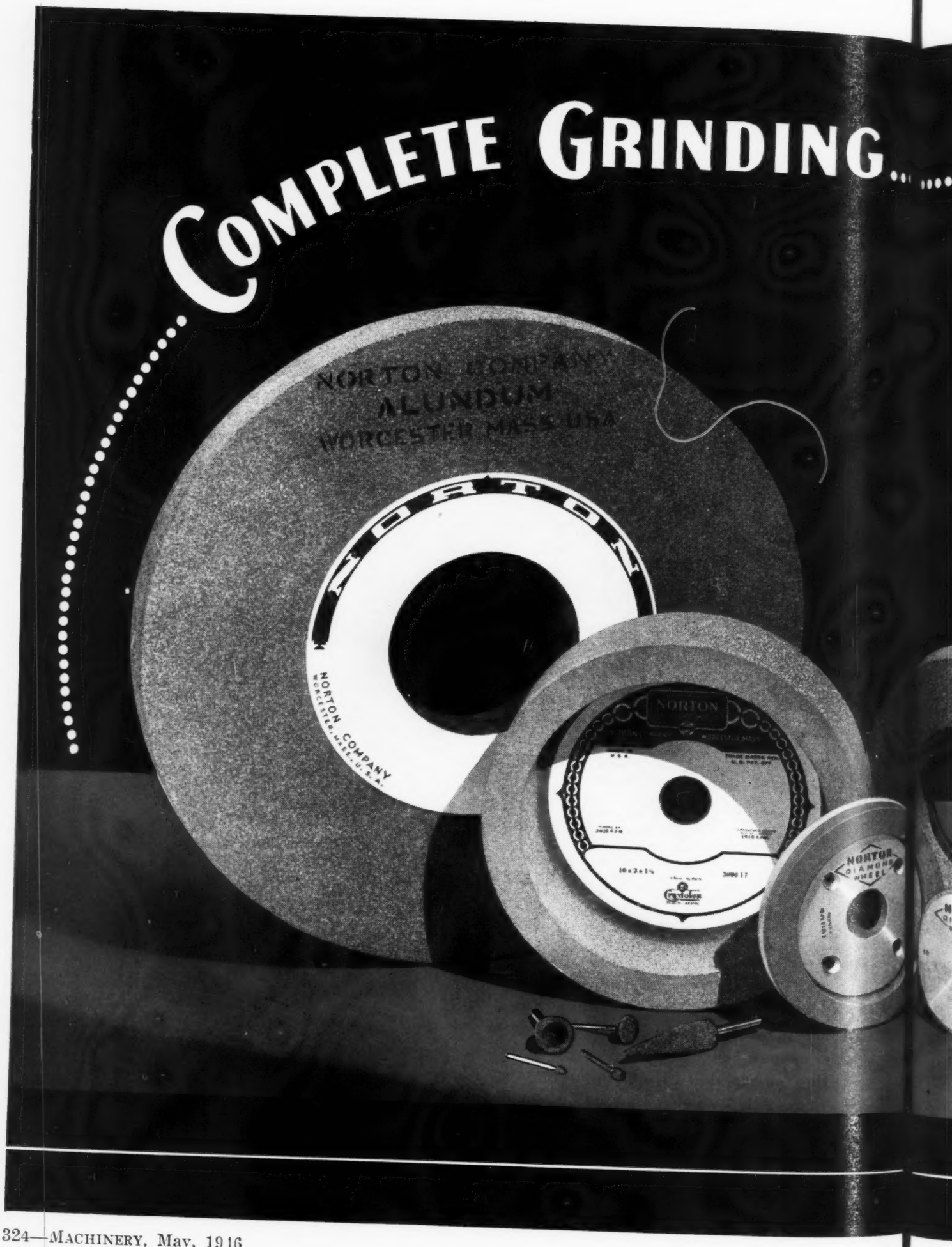
THE AMERICAN BRASS COMPANY

American Metal Hose Branch

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*


COMPLETE GRINDING
NORTON COMPANY
ALUNDUM
WORCESTER MASS. U.S.A.
NORTON
NORTON COMPANY
WORCESTER, MASS., U.S.A.
NORTON
NORTON
DIAMOND
WHEEL

....WHEEL SERVICE.....

for the Tool Room

The Right Wheel for Each Job
Local Engineering Service
Informative Literature and Films

For High Speed Steel Tools

Alundum, 38 Alundum and 57 Alundum "B-E" bond grinding wheels for sharpening tools and cutters of high speed steels and alloys of the Stellite type.

Open Structure grinding wheels for the jobs that require extra heavy stock removal or extra coolness of cut or both.

Fine grit grinding wheels for producing the high surface finish that greatly lengthens cutting tool life.

For Carbide Tools

Vitrified bonded diamond wheels for the off-hand grinding of single-point cemented carbide tools.

Resinoid bonded diamond wheels for sharpening multi-blade carbide tools such as milling cutters and the like.

Crystolon vitrified wheels (regular and Open Structure) for many roughing operations and for plants doing only a limited amount of carbide grinding.

For Dies and Molds

Mounted Points and Mounted Wheels are available in nearly 200 standard sizes and shapes in several abrasives and bonds.

Norton Open Structure wheels and segments are especially effective for the surfacing of heat-sensitive die steels.

Informative booklets and motion picture films on tool grinding available on request. Write today—no obligation.

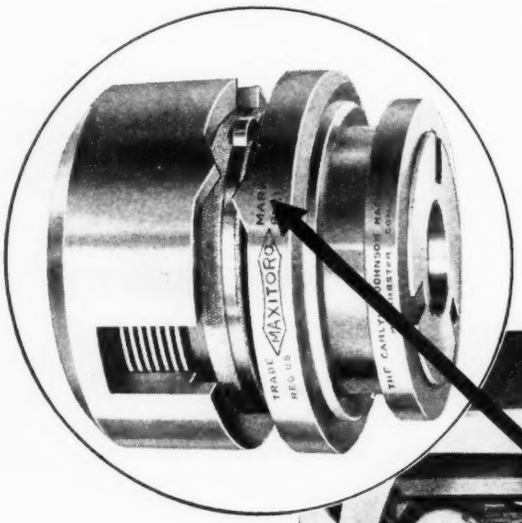
Norton Company, Worcester 6, Mass.

Distributors in All Principal Cities

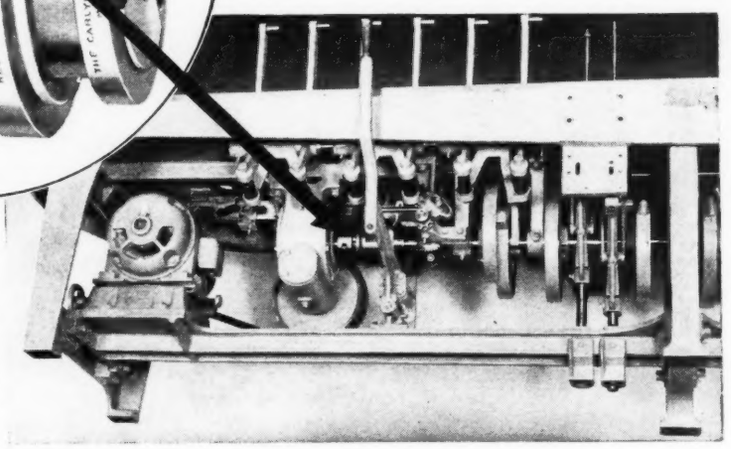
NORTON ABRASIVES

MAXITORQ FLOATING DISC MAXITORQ FLOATING DISC

For SAFETY... THE NEW MAXITORQ *automatic* OVERLOAD RELEASE CLUTCH



In addition to the many exclusive features which have given the Maxitorq Floating Disc Clutch such wide acceptance by manufacturers of machine tools and other machinery, we now present a NEW design . . . for Automatic Overload Release. It has a definite advantage on high speed machinery which processes breakable or damageable products.



The Overload Release feature is of exceptional value on this nationally known high speed Bottle Labeling Machine. It insures INSTANT automatic release on overload, preventing damage to work and equipment.

SENSITIVE ADJUSTMENT TO ANY OVERLOAD CONDITION

By means of a simple yet delicately made finger-tip adjustment the clutch can be made extremely sensitive to any overload condition. Disengagement is automatic and instant when overload takes place and the clutch slips positively into neutral.

Machinery manufacturers who have given this new clutch most careful tests at high speed operation report on its definite advantages. It may solve some of your difficult problems which involve overload clutches from ¼ to 5 H.P. (at 100 r.p.m.)

FLOATING DISC FEATURE

All approved Maxitorq design features of the Maxitorq clutch are the same . . . separator springs which "float" the discs, keeping them apart in neutral . . . no abrasion, no drag, no heating. And, no tools are required for assembly, adjustment or take-down.

There are so many varied applications of this Overload Release Clutch that we suggest submission of your transmission problems to our engineering department for practical recommendations.

BULLETIN No. M5 ON REQUEST

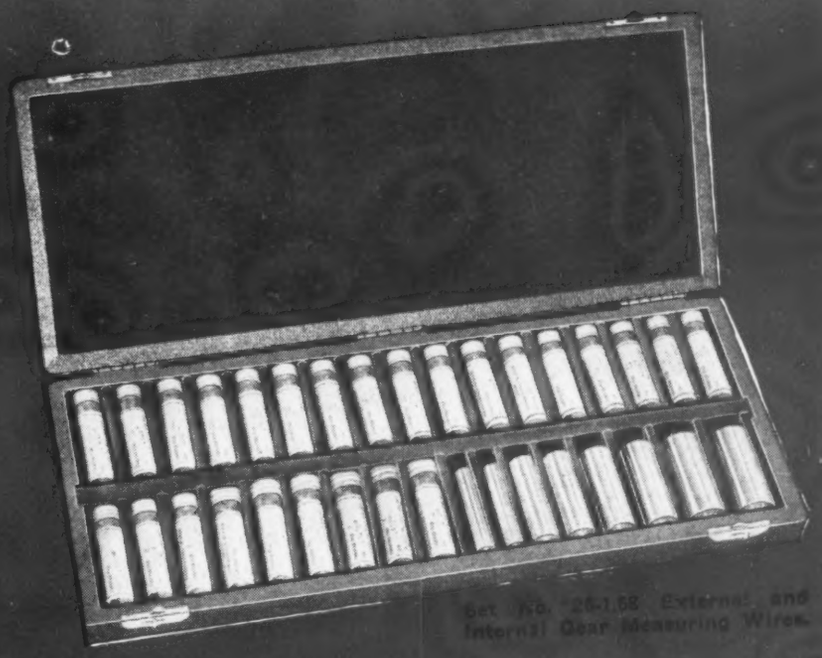
TRADE MAXITORQ MARK

THE CARLYLE JOHNSON MACHINE COMPANY
MANCHESTER CONNECTICUT

THE NEW

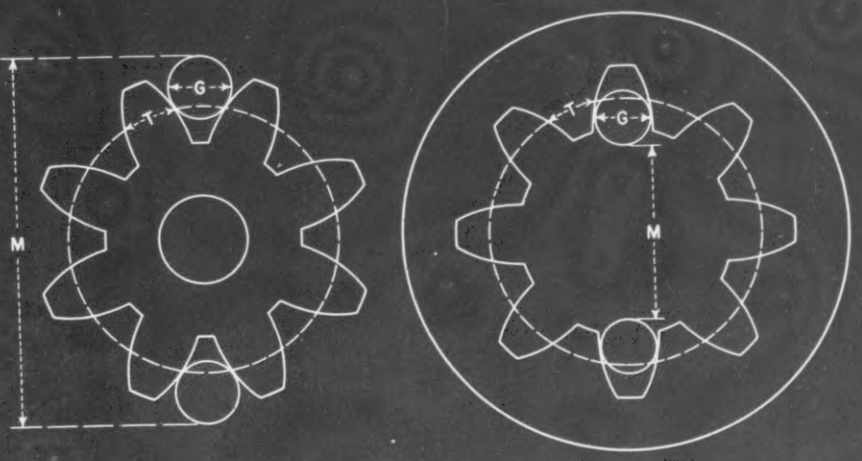
Van Keuren

simplified GEAR MEASURING SYSTEM



Set No. 26-1.68 External and Internal Gear Measuring Wires

with $\frac{1.68''}{DP}$ DIAMETER WIRE SIZES is the most accurate and economical method of measuring tooth thickness of external and internal spur gears. Also it may be applied to helical gears.



EXTERNAL SPUR GEAR INTERNAL SPUR GEAR

ULTIMATE ACCURACY

Catalog No. 33 is a manual of precision measuring systems, giving complete tables and simplified formulas for measuring standard and special threads, splines, gears and worms. Send for Catalog 33 and Circular G 37.

SIMPLE! . . . . The only calculation required is one of simple division.

RELIABLE! . . . . The system is favored by outstanding American Gear Manufacturers.

ACCURATE! . . . . The Van Keuren 1.68" Gear Tables (Cir. G 37) are complete for gears from 5 to 500 teeth and for pressure angles of 14½°, 17½°, 20°, 25° and 30°. If the measurement over the wires is greater than the value calculated from the tables, the tooth is too thick and cutter must be fed further into the gear blank. Exact constants for controlling tooth thickness and backlash to .0001" are given for all pressure angles.

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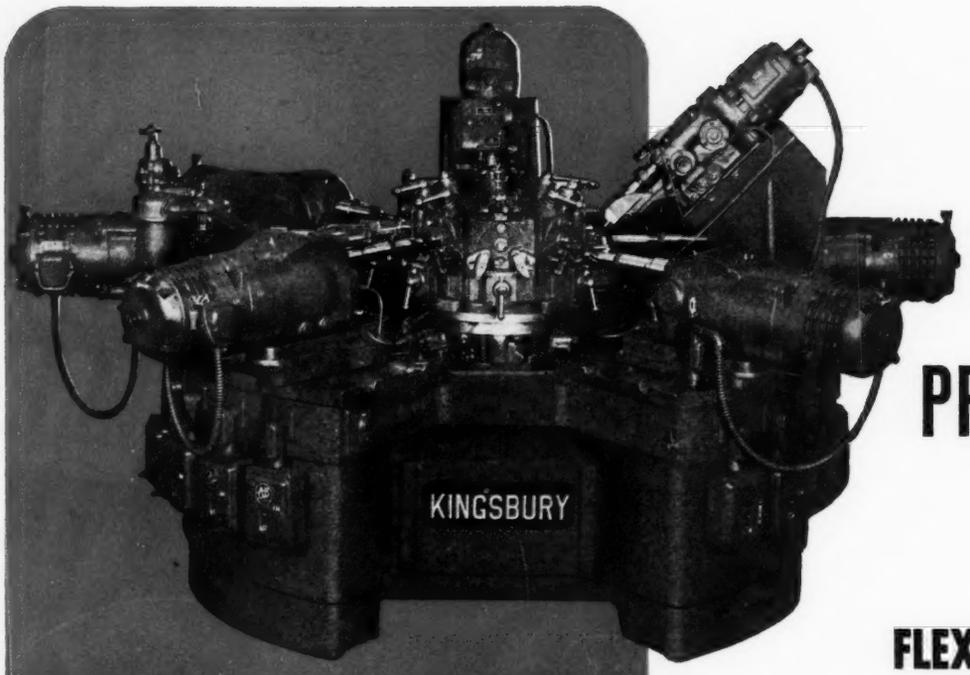
Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires.



HIGHER PRODUCTIVITY through the FLEXIMATIC METHOD*

A KINGSBURY AUTOMATIC INDEXING FLEXIMATIC *

MAKES THE PART—A CAST IRON WORM GEAR BLANK

COMPLETING 7 MACHINING OPERATIONS

IN 14.2 SECONDS

Higher second operation production of cast iron worm gear blanks was the immediate result of the application of Kingsbury multiple machining methods. The *Kingsbury Fleximatic* illustrated consists of eight *standard* Kingsbury drilling heads mounted on a *standard* Kingsbury base equipped with an eight station automatic indexing turret. In a single chucking, all indicated drilling, reaming, and spotfacing operations are completed. A single operator loads rough blanks, trips the machine, and the cycle begins. While the cutting units are working, the operator removes a finished part and reloads the work holder at his station. *The cycle is completed in 14.2 seconds.*

Such multiple machining performance can be duplicated on many parts, yet, because *Kingsbury Fleximatics* are assembled from standard units, you have a special purpose machine at much lower cost. It will pay you to investigate the high production capacity and unusual flexibility of Kingsbury Fleximatics. Let our engineers study your production problems; it does not obligate you.

WE PUT OUR HEADS TOGETHER TO CUT YOUR DRILLING COSTS

KINGSBURY
MACHINE TOOL CORP.
KEENE, NEW HAMPSHIRE

Write for Bulletin E

*** KINGSBURY FLEXIMATIC**

—a special purpose machine for combined automatic operations during a single chucking —the result of Kingsbury engineering ability in the use of low cost *standard* Kingsbury drilling and tapping heads on *standard* Kingsbury bases.

HOLES IN A HURRY!

DUMORE HIGH SPEED BENCH DRILL

HIGH SPEED MOTOR—1/30 HP Universal motor, equipped with self-aligning sleeve bearings, provides speeds from 2,000 to 15,000 R. P. M.

No. 0 JACOBS CHUCK—provides a capacity for drill sizes from No. 60 to No. 30 drills.

LARGE WORKING AREA—Three-inch diameter table permits drilling to center of six-inch circle.

UNUSUAL FLEXIBILITY OF ADJUSTMENT—Movement of work table accurately regulated by adjustable feed stopnuts.

FULL CONTROL OF SPEED—A foot rheostat enables operator to vary speeds according to the operation, with both hands free for work.

SMALL—LIGHT—PORTABLE—Weighs only 15 lbs.... overall height only 14½" ... can be easily moved wherever needed.

SOLID, STABLE BASE — Measuring 5" x 8", it insures the stability needed for precision work.

● Conveniently small, compact, and light in weight, Dumore's High Speed Bench Drill performs scores of precision drilling operations at production pace. Its wide range of speed, full control of speed, adjustable features, and precision construction make it ideal for tool shop or production work within its range. The Dumore Co., Tool Division, Dept. TE28, Racine, Wis.

$50.00 (Universal Motor — DC to 60 cycle AC 115 and 230 volt standard)

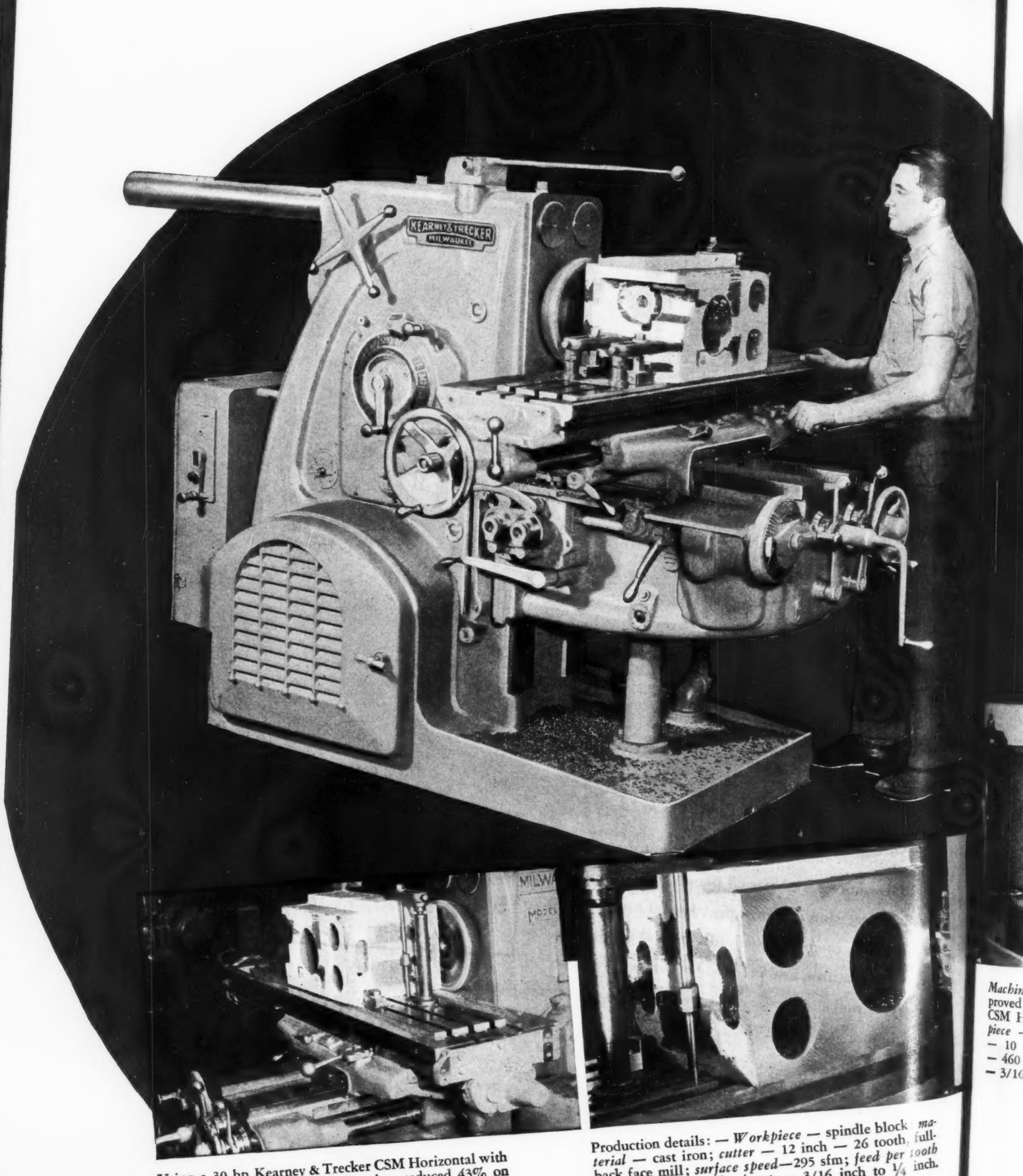
DUMORE
PRECISION TOOLS

WRITE FOR CATALOG 42

Catalog 42 contains full information on the Dumore High Speed Bench Drill and other Dumore precision tools, including tool post grinders and hand grinders. Write for your copy!

SOLD BY AUTHORIZED INDUSTRIAL DISTRIBUTORS IN ALL PRINCIPAL CITIES

The Most Powerful Milling



Using a 30 hp Kearney & Trecker CSM Horizontal with carbide cutters, total production time reduced 43% on this face milling operation.

Production details: — *Workpiece* — spindle block *material* — cast iron; *cutter* — 12 inch — 26 tooth, full-back face mill; *surface speed*—295 sfm; *feed per tooth* — .014 inch; *depth of cut* — 3/16 inch to ¼ inch.

g Machines of Their Type!

20-30-50 hp

Kearney & Trecker CSM's

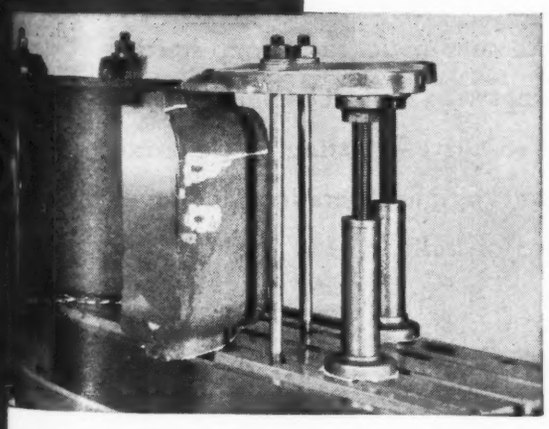
★ You get new high rates of metal removal—ferrous and non-ferrous — without sacrifice of precision.

★ —you get closer tolerances—finer finishes—precision performance — through smooth flow of power to the cutter.

★ —expressly designed for carbide milling of steel but adapted to all-purpose milling, as well.

★ —broad range of application — wide range of speeds and feeds.

★ —exceptional ease of operation — centralized conveniently located controls.



Machine Time Reduced 87%:—surface finishes improved when this operation was performed on a 20 hp CSM Horizontal using carbide milling cutters! *Workpiece* — bearing shell; *material* — cast steel; *cutter* — 10 inch, 12 tooth CSM face mill; *surface speed* — 460 sfm; *feed per tooth* — .010 inch; *depth of cut* — 3/16 inch to 1/4 inch.

Engineered—from the ground up—for every milling need of today and tomorrow — investigate Kearney & Trecker CSM's; write for Catalog No. CSM-20.

Kearney & Trecker
CORPORATION
MILWAUKEE 14, WISCONSIN

"Be Ready for Tomorrow — with CSM's!"

This Rotary Plow Feeder RUNS ITSELF

Arrows indicate units of Reliance V★S Drive on Robbins Rotary Plow Feeder at ore-mixing plant of Colorado Fuel and Iron Corporation.

With Reliance V★S Drive

This materials-handling machine works like a robot—moving back and forth all day long at the exact speed required to plow a steady stream of material onto a conveyor belt.

Here is an application of Reliance V★S Drive which you may be able to apply profitably. V★S—*the All-electric, Adjustable-speed Drive operating from A-c. Circuits,* provides smooth speed changes over practically an unlimited range, with automatic reversing, starting and stopping. Let a Reliance Engineer show *you* how V★S Drive—rotating or electronic system—can speed up operations and lower costs. Write for Bulletin 311.

RELIANCE ELECTRIC & ENGINEERING CO.
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RELIANCE A-C D-C MOTORS

"Motor-Drive is More Than Power"

PROFITABLE MAY PRECISION

Profitable precision is precision that's easily controlled. Make May—and every month — a month of profits by using Bath Gages. The Patented Chip Cleaner removes all chips from the threaded hole, eliminates costly rejects due to chip interference alone.

PRECISION

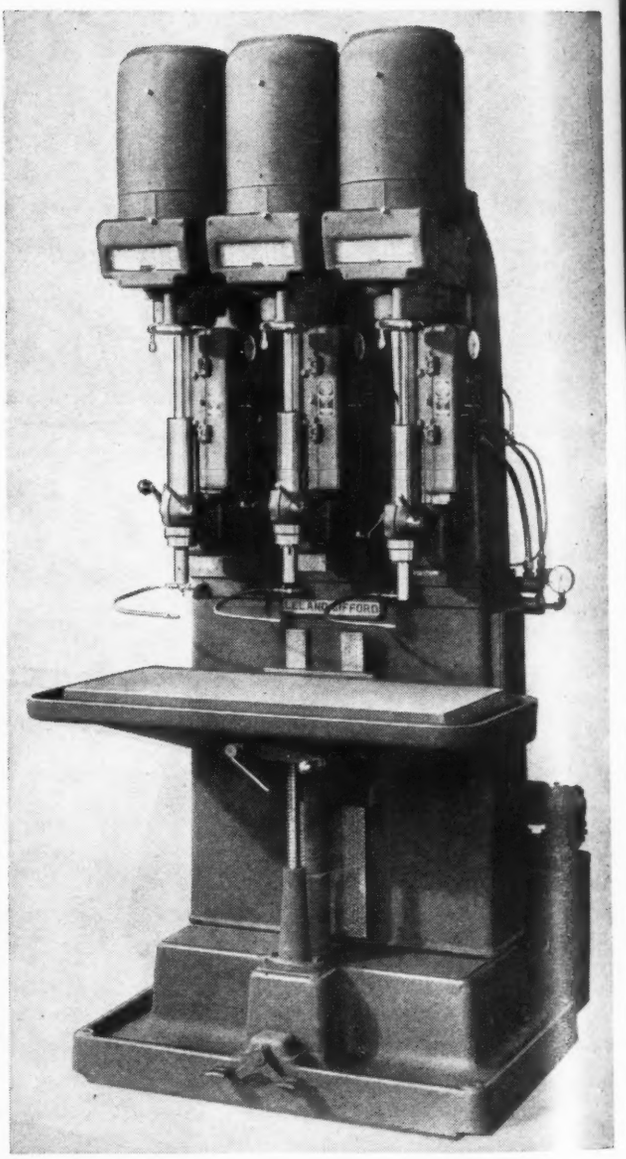
BATH GAGES

John Bath and Company, Incorporated, Worcester, Mass., U. S. A.

STEP by STEP DRILLING

LONG or DEEP HOLES

DRILLED STRAIGHT & FAST with regular twist drills and ordinary holding methods on **LELAND-GIFFORD** Hydraulic Feed Step-by-Step drilling machines.



In the Step-by-Step Feeding Method the chips are regularly removed from the hole which is flooded with lubricant to the bottom. This assures longer drill life between grinds, less drill breakage, straight holes and high production.

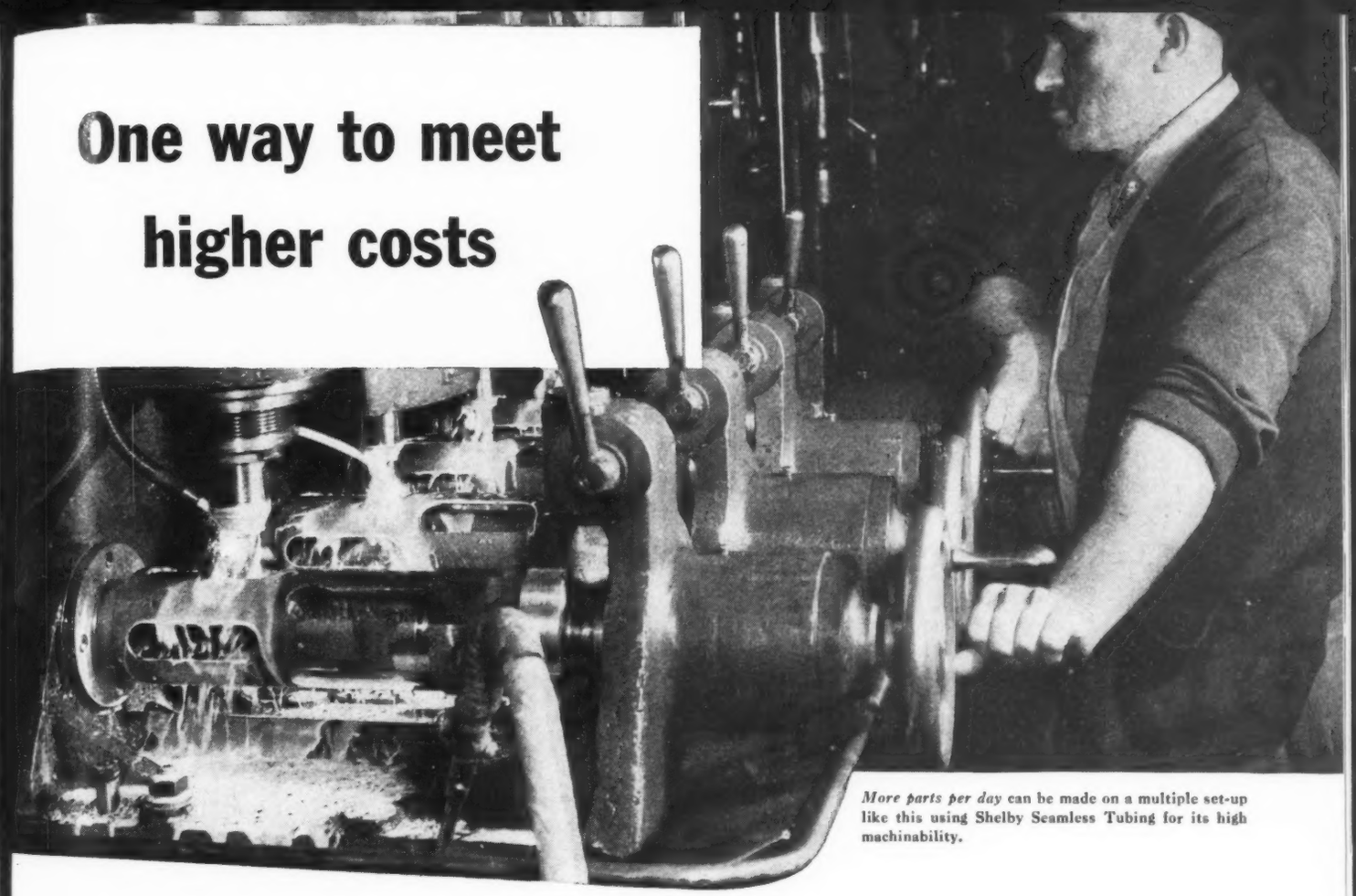
Particularly advantageous in drilling long oil holes in crankshafts, connecting rods and king bolts or any small long holes.

LELAND-GIFFORD HYDRAULIC FEED is as easily applied to LELAND-GIFFORD sensitive drills now in operation as it is to new machines. Let us tell you about it.

LELAND-GIFFORD

WORCESTER 1, MASSACHUSETTS, U. S. A.

One way to meet higher costs



More parts per day can be made on a multiple set-up like this using Shelby Seamless Tubing for its high machinability.

Use Seamless Tubing and get more production per man-hour

It takes ingenuity to figure out ways to combat rising costs, but you can profit from the experience of others.

During the war, manufacturers learned that seamless steel tubing had advantages over solid forgings on scores of new type jobs. Production was increased many times by set-ups such as the one illustrated above.

With Shelby Seamless Tubing you start out with the basic shape already made. This eliminates at least a forging and certain machining operations. The better machinability of Shelby Tubing and its uniform high quality permit fast production. Parts can be turned out at considerably less cost than those made by slower methods.

You can obtain Shelby Seamless Tubing processed to suit your particular requirements. Our service engineers work with you and with our own metallurgical department to develop the material most suitable for your machining operations.

Sizes of Shelby Seamless Tubing range from ⅜ inch to 10½ O.D. inches and in wall thickness from .035 inches to 1.500 inches cold drawn. Write for complete details and analyses available.

1. Connector for truck and trailer. 2. Roller for tractor. 3. Bearing shell. 4. Pump impeller. 5. Winder for textile machine.

SHELBY SEAMLESS *Steel Tubing*

WALLS WITHOUT WELDS

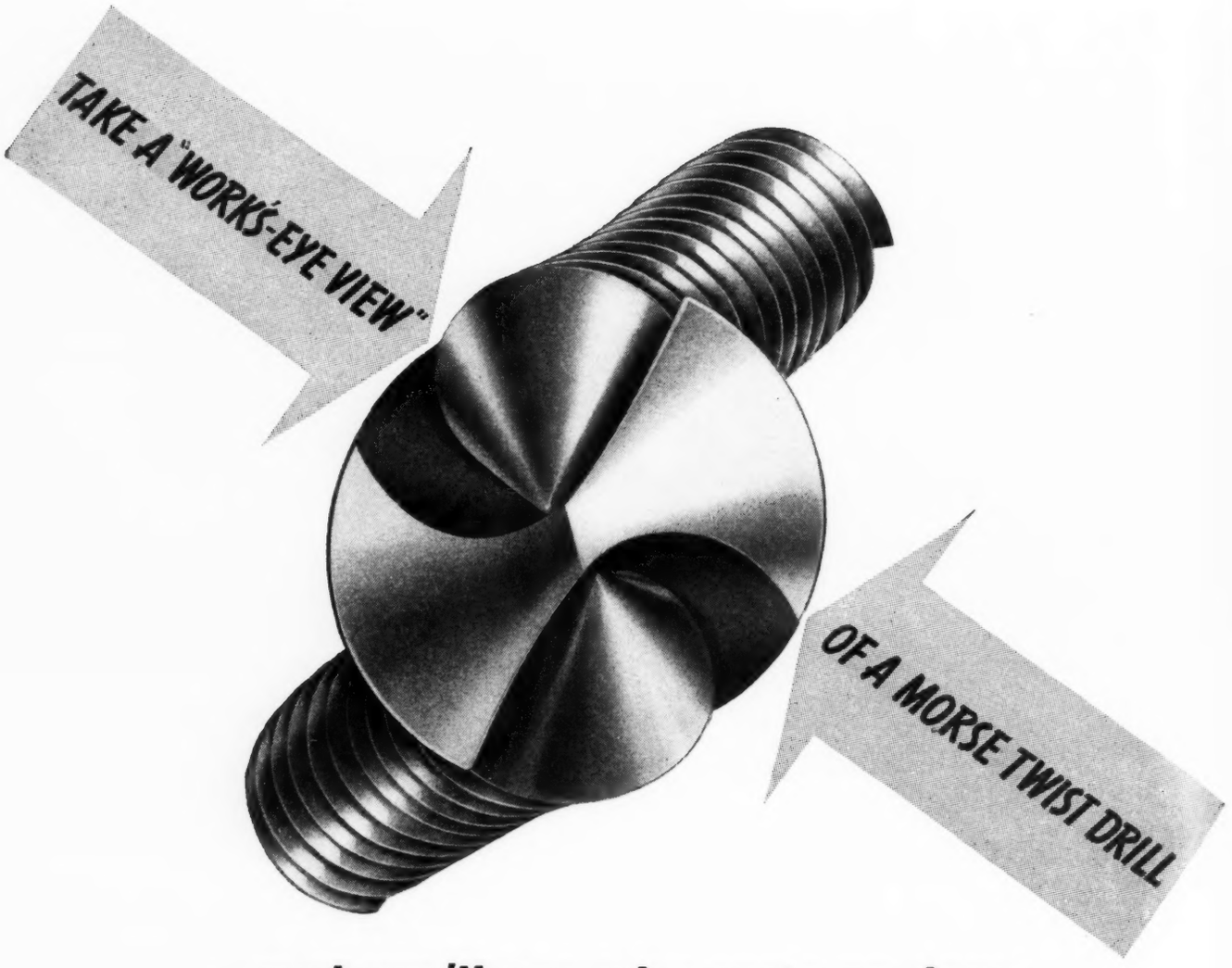
NATIONAL TUBE COMPANY

PITTSBURGH, PA.

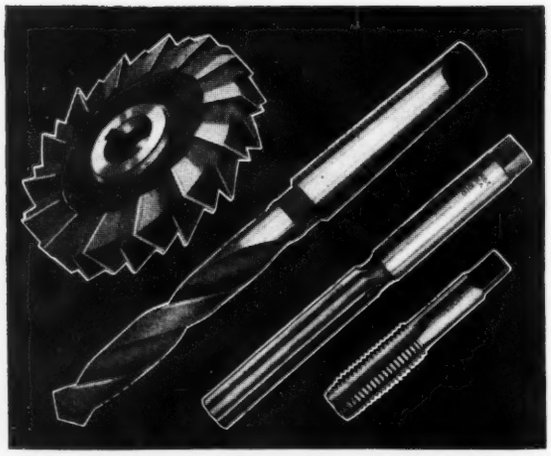
Tubing Specialties Division

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

UNITED STATES STEEL



...and you'll see why costs go down when Morse Cutting Tools go in!



AS ALWAYS—THROUGH DISTRIBUTORS

See the length of these chips. Here's proof for you . . . the best kind of proof . . . that Morse Drills are accurately ground, uniformly angled, and have just the right amount of lip clearance. Try them! They'll cut down work and tool spoilage . . . reduce down-time . . . make a *noticeable* difference in your production costs!

TO REDUCE COSTS, SPECIFY MORSE CUTTING TOOLS

MORSE

THERE *IS* A DIFFERENCE

TWIST DRILL AND MACHINE COMPANY
NEW BEDFORD, MASS., U. S. A.

NEW YORK STORE: 130 LAFAYETTE ST. - - - - CHICAGO STORE: 570 WEST RANDOLPH ST.
SAN FRANCISCO STORE: 1180 FOLSOM ST.

from 5 PER DAY to 20 PER HOUR !

ARMATURE-SHAFT AS SHOWN TURNED IN ONE CAM CYCLE ON GORTON SWISS-TYPE AUTOMATIC ...ACCOUNTED FOR THIS PRODUCTION INCREASE FROM 5 PIECES PER DAY TO 160 PIECES PER DAY

Production results similar to this can be obtained when Gorton Swiss-Type Automatics are employed. This armature shaft was formerly turned on a bench type lathe. The bearing surfaces were ground. Output was 5 shafts per day. Shaft production was the major bottleneck in the manufacture of fractional horsepower motors and—costs were too high.

To remedy this situation, the job was tooled for a Gorton Automatic. Due to the unusual length of the shaft (6"), it was "double chucked." Production jumped from 5 per day to 20 per hour—3100%—and the grinding operation was eliminated. Required tolerances were consistently held.

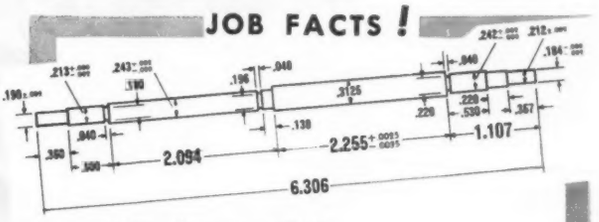
GORTON AUTOMATICS EXTREMELY VERSATILE

With a Gorton Swiss-Type Automatic you can obtain production results equally as outstanding as that described above on a wide variety of work. Gorton Automatics will turn diameters from .005" to 7/16"... will produce parts in lengths of from 1/32" to 6"... will perform centering, drilling, reaming, tapping, threading, slotting, counterboring, back recessing and generating operations... will hold tolerances as close as .0002" on long slender parts of multiple diameters.

CONSULT GORTON ENGINEERING SERVICE

Perhaps some of the work at which you are now engaged could be accomplished better, faster, with more economy on a Gorton Swiss-Type Automatic. If you will mail detailed prints of the parts being run to Gorton Engineering Service, our engineers will furnish you with complete tooling information and production estimates. There is no charge or obligation.

JOB FACTS !



PART—Armature Shaft.
OPERATION—Turn all diameters and undercuts as shown.
MATERIAL—416 Stainless Steel.
MACHINE—Gorton 16-B Swiss-Type Automatic.
FINISH—Less than 25 micro-inches.
LIMITS—Closest tolerance ±.001".
PRESENT PRODUCTION—20 per hour.
FORMER METHOD—Bench lathe.
FORMER PRODUCTION—5 per day.
REMARKS—3100% increase in production by tooling job on a Gorton.

FREE SCREW MACHINE DATA YOU NEED

Learn all of the details about the Gorton Automatic... its design, construction, method of operation. See how it can be applied to your production, how it can be used to improve your whole machining setup. This and other valuable screw machine information is contained in the new Gorton Bulletin No. 1800. Send for your free copy today.

GEORGE GORTON MACHINE CO.

1305 RACINE STREET, RACINE, WISCONSIN, U.S.A.

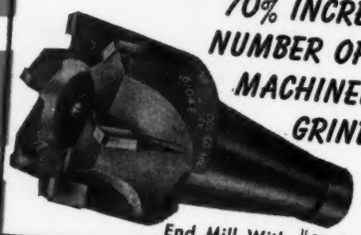
NELCO Carboloy-Tipped CUTTING TOOLS

TAGGED FOR *Faster* **PRECISION Production**

Shell Mill

HEAVY, RUGGED BRAZED-IN TYPE WITH HIGH-STRENGTH BODIES

70% INCREASE IN NUMBER OF PIECES MACHINED PER GRIND



End Mill With #50 Taper Shank

Face Mill

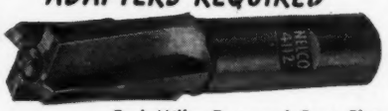
DESIGNED FOR FLYWHEEL ACTION

Half Side Mill

LESS TIP BREAKAGE

Side Mill

FOR MOUNTING ON STANDARD EQUIPMENT—NO SPECIAL ADAPTERS REQUIRED



End Mill—Two and Four Flute Straight and Taper Shank

ALL CARBOLOY TIPPED END MILLS REDUCED 10% IN PRICE!

SAVE Hundreds of Valuable PRODUCTION HOURS By Giving The NELCO FIELD ENGINEER A Few Minutes Time!

Write for additional detailed literature.

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NELCO TOOL CO., INC.

For That EXTRA EDGE In Production

370 Hamilton Avenue, Dept. MC, Brooklyn 31, N. Y.

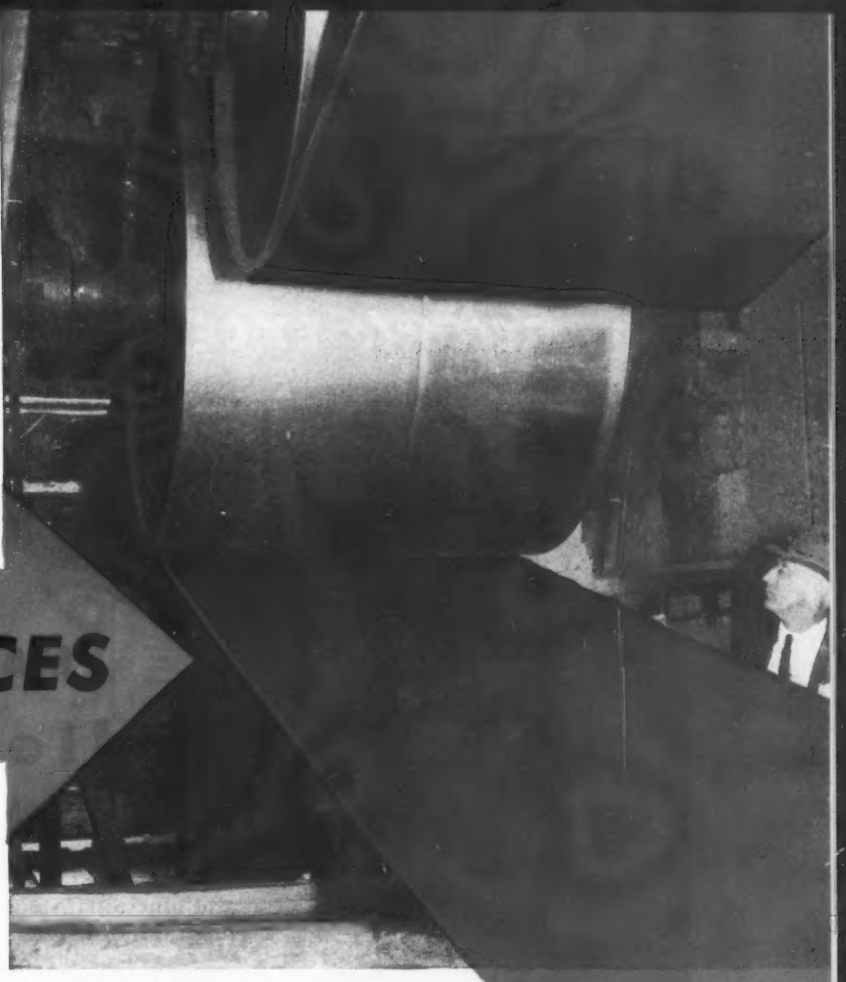
You Get a Complete *Selection* of

RIVING SURFACES

in

MANHATTAN

UBBER TRANSMISSION BELTS



hattan offers a complete range of special surfaces on the driving side ransmission belts to meet all the needs of industry. These are all avail- in Manhattan's patented Compensated Belt with ply-stresses equalized.

YLE H - HYCOE DRIVING SURFACE -

low-tension operating surface available for general service. The accom- ying graphs and list of 7 advantages show how the Manhattan Hycoe face contributes to belt, bearing, and power economy.

dvantages

1. Less bearing, shafting, and hanger troubles
2. Operations less affected by atmospheric conditions
3. Higher overload capacity or margin of safety
4. Less wear on pulley side
5. Can be dressed without injury to the belt
6. High production efficiency
7. Material reduction in belting costs

YLE F - FRICTION SURFACE -

igned for heavy drives where a slight amount of starting-slip only is not rimental. Also practical in extremely dusty surroundings or where there chips, grit, or other foreign substances present.

YLE B - BAREBACK SURFACE -

reated duck surface for drives where slip is necessary, as on the various e-ups on rolling operations, loom winding, paper take-up machines and utomatic stops and shifter drives.

YLE BB - BAREBACK BOTH SIDES -

igned for special conditions where slip is neces- on both sides, as for feed belts on tractor and ll steam saw mills.

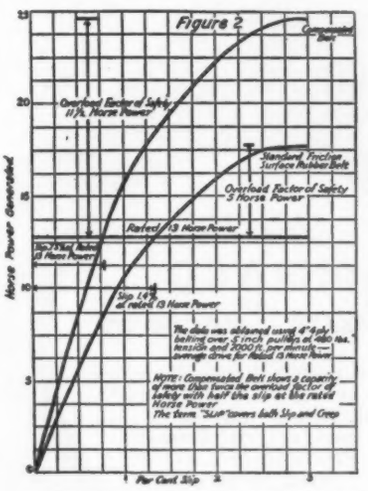


Figure 2
Compensated Belt
Overload Factor of Safety 11⅞ Horse Power
Standard Friction Surface Rubber Belt
Overload Factor of Safety 5 Horse Power
Rated 13 Horse Power
Slip 1.4% at rated 13 Horse Power
The data was obtained using 4"4ply belting over 5 inch pulleys at 480 lbs. tension and 2000 ft. per minute — average drive for Rated 13 Horse Power
NOTE: Compensated Belt shows a capacity of more than twice the overload factor of safety with half the slip at the rated Horse Power
The term "Slip" covers both Slip and Creep
Horse Power Generated
Per Cent Slip

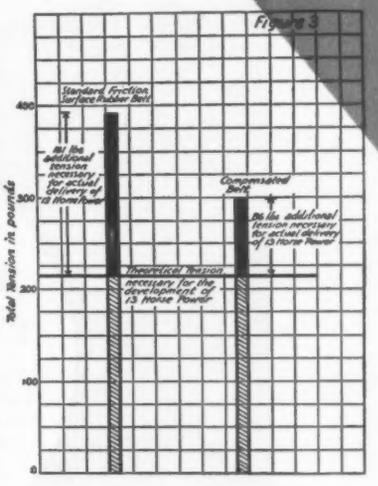


Figure 3
Standard Friction Surface Rubber Belt
Compensated Belt
Theoretical Tension necessary for the development of 13 Horse Power
Total Tension in pounds

Figs. 2 and 3—Show the performance characteristics of Condor Compensated Belt with Hycoe Surface on pulley side compared with those of standard rubber belt.

CONDOR COMPENSATED BELT (Manhattan's patented belt with Equalized Ply Stresses) is furnished with Style H Surface, unless otherwise specified.

CONDOR STANDARD and other **BELTS** are made with Style F Surface regularly.

CONDOR WHIPCORD ENDLESS BELTS are made with Style F Surface, unless otherwise specified.

Manhattan also makes *Non-Spark, Oil-Proof* and Acid-Proof belts—For complete service from a single source. **USE MANHATTAN BELTING.**

Manhattan belts will be made in the red color when again possible.

RAYBESTOS R M MANHATTAN

RAYBESTOS-MANHATTAN, INC

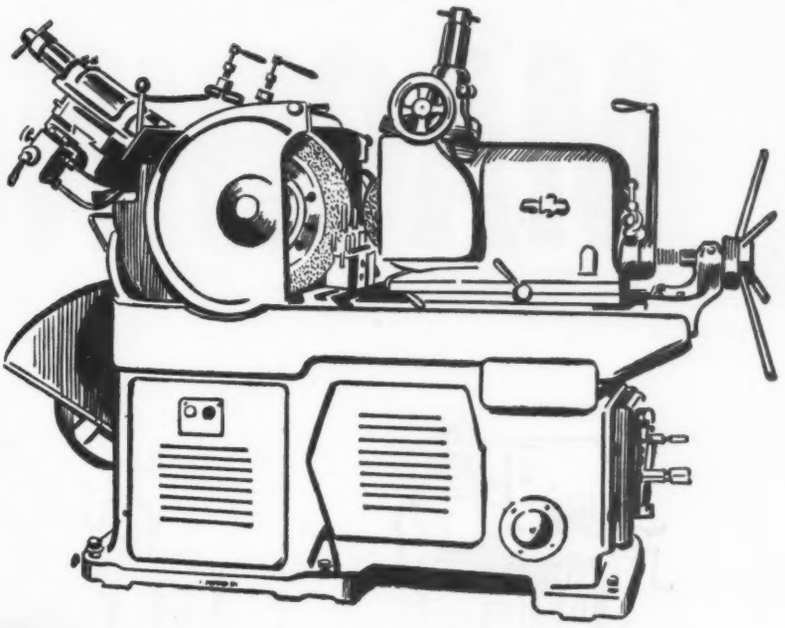
MANHATTAN RUBBER DIVISION

EXECUTIVE OFFICES AND FACTORIES PASSAIC, NEW JERSEY

EXCELLENCE OF THE PRODUCT
Reflects EXCELLENCE OF THE PROCESS
MADISON-KIPP
die/castings
by the millions
The Coffee Dispenser parts illustrated, have both ornamental and functional value. They are made of aluminum under high pressure and have thin sections — down to .040″.
Die Casting offers the product designer great freedom of design, strong light sections and attractive appearance at no cost penalty and often at a substantial saving.
MADISON-KIPP CORPORATION
203 WAUBESA ST., MADISON 4, WISCONSIN, U. S. A.
Skilled in die casting mechanics, experienced in lubrication engineering, originators of really high speed air tools.
ANCIENS ATELIERS GASQUY, 31 Rue du Marais, Brussels, Belgium, sole agents for Belgium, Holland, France and Switzerland.
Wm. Coulthard & Co. Lt., Carlisle, England, sole agents for England, most European Countries, India, Australia, and New Zealand.
The New
AMMACO
Coffee Dispenser
"The perfect home dispenser for coffee, tea, malted milk, and baking powder" . . . a product of Ammaco Products, Inc., of St. Paul, Minnesota

GOVERNMENT-OWNED SURPLUS PRODUCTION EQUIPMENT

CINCINNATI CENTERLESS GRINDERS: Model No. 2 located in Detroit, Chicago, Cleveland, Boston, Philadelphia and New York; Model No. 3 located in Detroit, Chicago, Cleveland, and Boston Regional Offices.



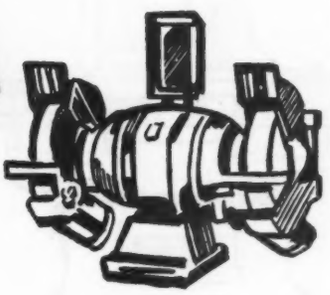
STANDARD MAKES

STANDARD MODELS

CENTERLESS GRINDERS

Do you need additional machine tools for new operations . . . or to speed up old? Thousands of machine tools, like these grinders, are surplus and available to you at low cost. The equipment is modern; much of it unused, some only slightly used. Look today for places to use this equipment. You will be rendering a vitally important service—not only to yourself as a producer and taxpayer—but also to the country as a whole. These tools *must* go to work to produce badly needed peace time products.

BENCH GRINDERS



BROWN-BROCKMEYER: 2-wheel, electric bench grinders in 8" and 10" wheel sizes located in San Antonio Regional Office of War Assets Administration.

VETERANS OF WORLD WAR II

To help you in purchasing surplus property, veterans' units have been established in each War Assets Administration Regional Office.

MAIL TODAY

To War Assets Administration:

Please send me information on the availability of the following types of grinders:

MAKE	MODEL	SIZE	
.....	.....	.....	Centerless grinders
.....	.....	.....	Bench grinders
.....	.....	.....	.....grinders (other)

Name.....

Firm.....

Address.....

City.....State.....

277-3

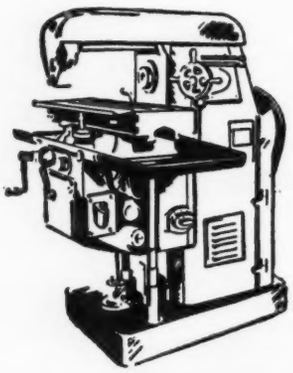
WAR ASSETS ADMINISTRATION

OFFICES LISTED BELOW ARE TEMPORARILY IN RECONSTRUCTION FINANCE CORPORATION AGENCIES

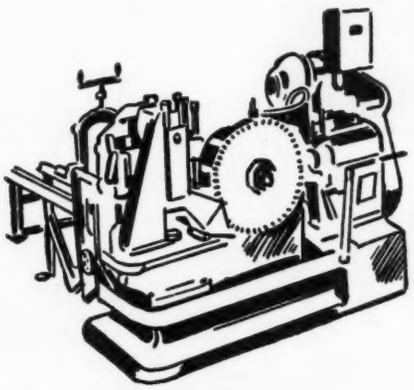
Offices located at: Atlanta · Birmingham · Boston · Charlotte · Chicago · Cleveland · Dallas · Denver Detroit · Helena · Houston · Jacksonville · Kansas City, Mo. · Little Rock · Los Angeles · Louisville Minneapolis · Nashville · New Orleans · New York · Oklahoma City · Omaha · Philadelphia Portland, Ore. · Richmond · St. Louis · Salt Lake City · San Antonio · San Francisco · Seattle · Spokane Cincinnati · Fort Worth (Telephone 3-5381)

GOVERNMENT OWNED SURPLUS

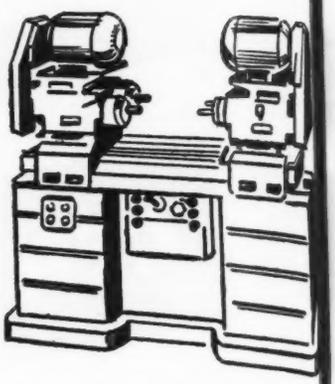
MACHINE TOOLS



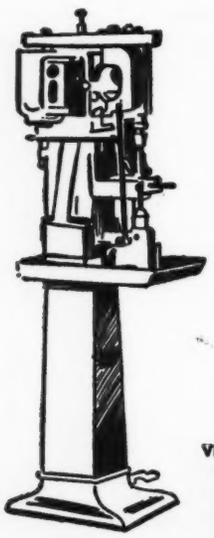
AUTOMATIC BED TYPE MILLING MACHINES
Models 1-12 and 1-18, located in New York, Detroit, Cleveland, Chicago, and Boston Regional Offices.

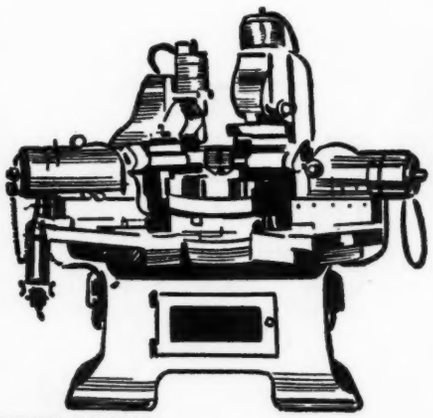


COLD SAWING MACHINES, CIRCULAR
1½" to 21" capacity, in standard models of well known makes, located in Detroit, Chicago, Cleveland, Philadelphia, Boston Regional Offices.

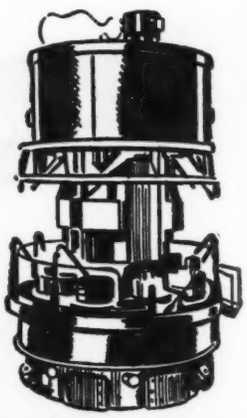


PRECISION BORING MACHINES
Both single and double end types located in Detroit, Chicago, Boston, Cleveland, Minneapolis, Kansas City and, in lesser quantities, other Regional Offices.





VERTICAL & HORIZONTAL DRILLING MACHINES
Special Kingsbury type machines located in Boston, Chicago, Detroit, Philadelphia, Richmond, St. Louis and, in limited quantities, other Regional Offices.



LATHE, MULTIPLE SPINDLE, AUTOMATIC VERTICAL CHUCKING
Largest inventories located in Boston, Chicago, Cleveland, Detroit, New York and Philadelphia.

WAR ASSETS ADMINISTRATION

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PRODUCTION EQUIPMENT

NOW!

MODERN MACHINES . . . MANY MODELS . . . STANDARD MAKES

These machine tools *must* go to work. You need the profits. America needs the production. Taxpayers need maximum recovery to the government of their original cost. On hand, at every War Assets Administration office in the U. S. there are hundreds of these machines. Nearly every category of modern production equipment can be obtained at low cost. You have a unique opportunity to initiate new enterprises or modernize old . . . and at the same time do your country an important service. Check this partial list over carefully for equipment you can use. Then write, wire, or phone your nearest War Assets Administration office for detailed information, or if you prefer mail the coupon.

CHECK LIST OF SPECIAL MACHINE TOOL BUYS!

Here are a few of the many thousands of machine tools available through War Assets Administration.

MACHINE (Function)	TYPE	SIZE OR CAPACITY	Quantity Available Now
Boring, Drilling & Milling	Horizontal	Under 3" to 6"	209
Boring & Turning Drills	Vertical	Under 36" to 120" Swing	683
Boring Fixed Rail Tank Mill	Vertical		87
Precision Boring Machines	Horizontal bridge—single end	Under 8" to 14"	486
	Horizontal bridge—double end	Under 8" to 14"	226
Drills	Box column—single spindle	Under ½" Cap.	
		Up to 22" Swing	287
		½" to 1" Cap.	
		16" to 24" Swing	187
	Round column—single spindle	Under ½" Cap.	
		Up to 22" Swing	738
		½" to 1" Cap.	
		16" to 24" Swing	1163
	Sensitive Floor & Pedestal Box column	Under ½" Cap.	
		12" to 22" Swing	933
		½" to 1" Cap.	
		16" to Over 24" Swing	1875
		1" Cap. and over	
		24" Swing and over	434
	Sensitive Floor & Pedestal Round column	Under ½" Cap.	
		12" to 22" Swing	384
		½" to 1" Cap.	
		Under 16" to 24" Swing	1131
Drills	Sensitive Floor & Pedestal Upright Type—Box column	Up to 28" Swing	549
	Sensitive Floor & Pedestal Upright Type—Round column	Up to 28" Swing	161
	Heavy Manufacturing Type	Up to 32" Swing	296
	Spec. Kingsbury Way & Vertical		250
Gear Hobber	Horizontal	4" to 16" Cap.	321
	Vertical—Universal	Under 16" Diameter	89
Gear Shapers	External & Internal	Up to 40" Diam.	280
	Spur—External only		152
	Spur & Helical—External & Internal	Up to 25" Diam.	275
	Spur & Helical—External only		159
Gear Cutters	Bevel Type not incl. Plainer Type Str. Bevel	Up to 36" Diam.	377
Gear Tooth Finisher	Generating Type Grinding		140
	Formed Wheel Type		190
Gear Tooth Lapper	External only		80
	Comb. External & Internal		57
Gear Tooth Shaver	Rotary Type		133
Grinder	External Cylinder—Plain	Up to 20" Swing	1730
	External Cylinder—Universal	Up to 16" Swing	347
	Centerless—Internal and External	All sizes	607
	Cam		223
	Crank Pin		83
	Valve		245
	Internal Cylinder—Mechanical Feed	All sizes	320
	Internal Cylinder—Hydraulic Feed	Up to 42" Swing	1094
	Internal Cylinder—	Under 12" Swing	151
	Internal Cylinder—Auto. Siz. Comb. Hole & Face	16" Swing and over	127
	Internal Cylinder—Auto. Siz. Planetary Type	Under 16" Diam.	39
	Internal Cylinder—Auto. Siz. Centerless	Up to 28" Diam.	146
	Surface—Horiz. Spindle Rotary Table	All size table diam.	274
	Surface—Vertical Single Spdl. Rotary Table	12" to 48" Table Diam.	157
	Surface—Reciprocating Horiz. Spindle—Hand Feed	12" length work cap. and over	146
	Surface—Reciprocating Horiz. Spindle—Power Feed	Under 18" to 120" length work cap.	840
	Thread—External only	All sizes	635
	Thread—External & Internal	8" Cap. and over	82
	Tool & Cutters—Universal	All sizes	691
	Drill	All sizes	348
	Single Point Tool	All sizes	458
	Bench—Double End	All sizes	2876
	Bench—Single End	Up to 8" Wheel diam.	1103
	Floor—Double End—Dry	Up to 24" Wheel diam.	831
	Floor Comb.—Wet & Dry	10" to 16" Wheel diam.	216
	Bench Floor & Snag—Swing Frame		155
	Comb. Grinder & Buffer		1805

EXPEDITING FREE! COUPON

Use this coupon to conserve your time. Print in a brief description of the make, type, model, and size of machine in which you are interested. We will determine *in advance* our stock situation on the machines and inform you quickly. No obligation, of course.

To War Assets Administration: Do you have in surplus stocks the following machine tools? Where are they located? What is their condition?

Type.....Make.....Model.....Size.....

....

....

Name.....Tel. No.....

Title.....

Firm.....

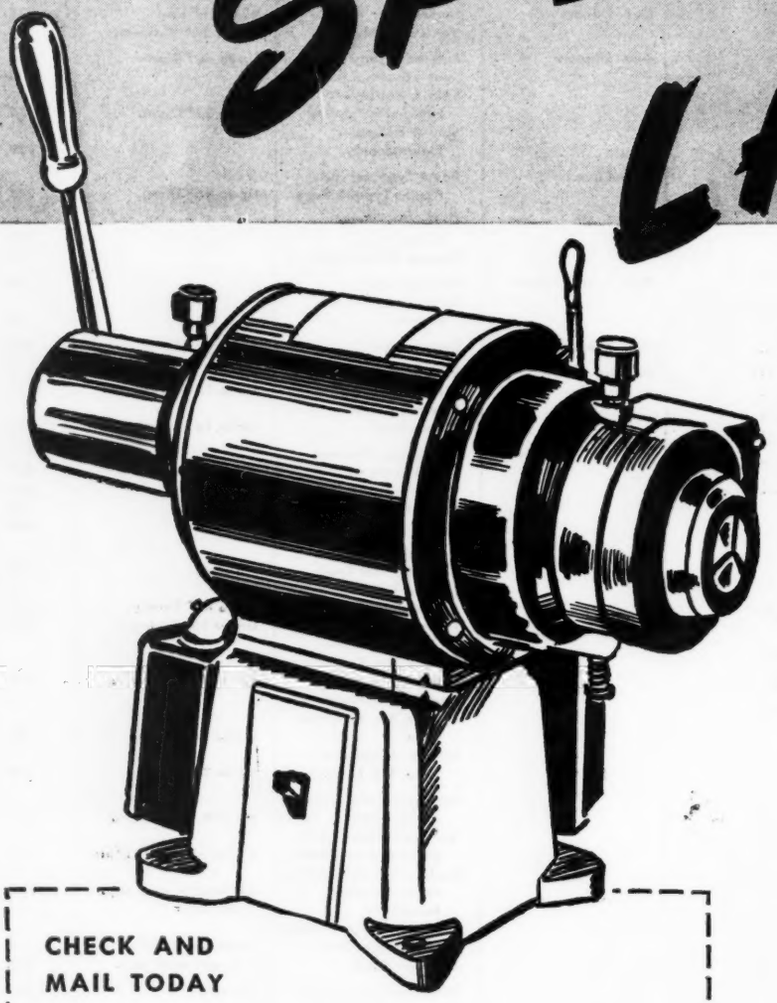
Address.....

City.....State.....

277-3

GOVERNMENT-OWNED SURPLUS PRODUCTION EQUIPMENT

SPEED LATHES



1/6 TO 5 H.P. STANDARD MAKES AT LOW COST

Speed Lathes like this are just one of dozens of kinds of modern machine tools now available from government surpluses. For instance look at the equipment shown on the three preceding pages. Of *immediate* machine tool needs, there is scarcely one which cannot be met quickly, and at low cost, from War Assets Administration stocks—and additional equipment is being declared surplus regularly. One of industries' and government's major post war tasks is to put this equipment to productive use quickly. More specifically—where can *you* use one or more of these speed lathes profitably? Find out today and contact any War Assets Administration Office.

WHERE SPEED LATHES ARE!

W.A.A. Regional Office	½ HP—	½ to 1 HP	1 to 3 HP	3 HP+
Detroit	204	231	147	22
Chicago	97	86	87	65
Boston	33	89	.....	.....
Cleveland	57	32	19	.....
New York	6	.....	3	.....
Denver	11	60	.....	.....
St. Louis	155	.....	26	.....
Minneapolis	67	14	6	.....
Spokane	3	11	.....	.....

CHECK AND MAIL TODAY

To War Assets Administration:
Without obligation, please send me the following information on lathes:

	MAKE	MODEL	SIZE
Speed Lathes ☐	.....	.....	.....
Multi-cut Lathes ☐	.....	.....	.....
Other types ☐	.....	.....	.....

Name.....

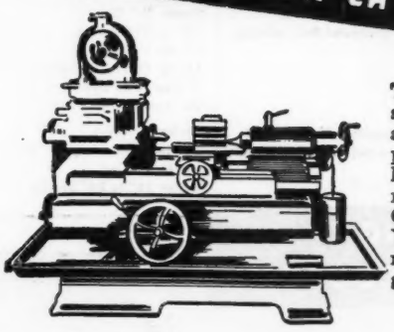
Firm.....

Address.....

City.....State.....

277-3

SMALL PIECE MULTI-CUT PRODUCTION LATHES



These Reid lathes may be stripped and retooled for any special kind of small production work. Machines located principally in Birmingham, Boston, Chicago, Cleveland, Detroit, New York, Philadelphia, Richmond and St. Louis Regional Offices.

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Logan A NAME TO REMEMBER WHEN YOU THINK OF BETTER LATHES

LOGAN TURRET LATHES

For Speed, Accuracy, Ease and Economy on a Wide Variety of Work

The speed, accuracy and versatility which made Logan Turret Lathes so effective in war production now bring increased efficiency and decreased costs to peacetime operations. Ruggedly built, with heavy hexagonal turrets, these lathes perform smoothly and accurately. They handle a wide variety of operations with the precision essential to fine work. Heavier and more expensive equipment can thus be released for larger work with an increase in both production and efficiency. Quickly and easily set up, Logan Turret Lathes minimize time loss between jobs. As in all Logan Lathes, the sustained accuracy, and dependable, economical operation of these turret lathes results from accurate, rugged construction and Logan advanced design. Spindles, for example, are mounted on special New Departure Ball Bearings which require no adjustment within the full Logan speed range of 30 to 1450 rpm, and which permit the use of high speed carbide cutting tools to full advantage. And the heavy beds, with oversize ribs and balanced sections, have two V-ways and two flat ways precision ground to within .0005" of parallelism. Similarly high standards of accuracy are maintained in building and assembling every part of these lathes. That is why ordering your Logan Turret Lathes now is sound preparation for production jobs ahead. Ask your Logan Lathe dealer, or write direct for full information.

SPECIFICATIONS COMMON TO ALL LOGAN TURRET LATHES . . . Swing over bed, 10½" . . . bed length, 43" . . . size of hole through spindle, 25/32" . . . distance across turret head flats, 5¼" . . . 6 positions with adjustable stops . . . self indexing . . . maximum stroke of turret, 4¼" . . . spindle nose diameter and threads per inch, 1½" - 8 . . . 12 spindle speeds, 30 to 1450 rpm . . . motor, ½ hp, 1750 rpm . . . ball bearing spindle mounting . . . drum type reversing motor switch and cord . . . precision ground ways, 2 V-ways, 2 flat ways. 1-1

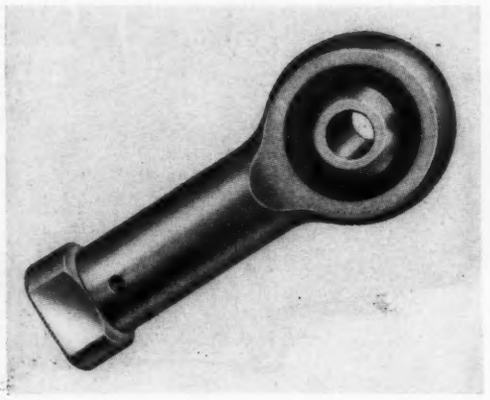
LOGAN ENGINEERING CO. CHICAGO 30, ILLINOIS

UNIBAL SPHERICAL BEARINGS *Improve Your Products*

Unibal
SPHERICAL BEARING ROD END MALE

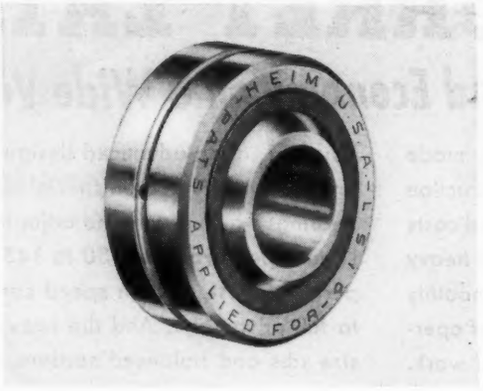
HERE is a precision-built bearing at a comparatively low cost which outperforms anything yet devised for the purpose. Used as a rod-end, its operation is as free as an eyeball in a socket. There is no double row of balls to break and jamb even on fairly light loads. The Heim Unibal Bearing will carry heavy radial and axial loads.

Unibal
SPHERICAL BEARING ROD END FEMALE



WHERE motion is to be transmitted at odd and perhaps varying angles, the Heim Unibal Bearing will correct misalignment in any direction. Applications for bearings of this type in your products or machines are many. This new Heim Bearing was used successfully in millions of airplane applications during the war.

Unibal
SPHERICAL BEARING



A PARTIAL list of products where Heim Unibal Bearings may be used includes: Electric fans, shoe machinery, textile machinery, engine controls for trucks and motors, marine applications, flexible couplings, cam followers, electrical equipment, sewing machines, road building machinery, printing presses, washing machines and laundry equipment, etc., etc.

UNIBAL SPHERICAL BEARINGS AND ROD ENDS

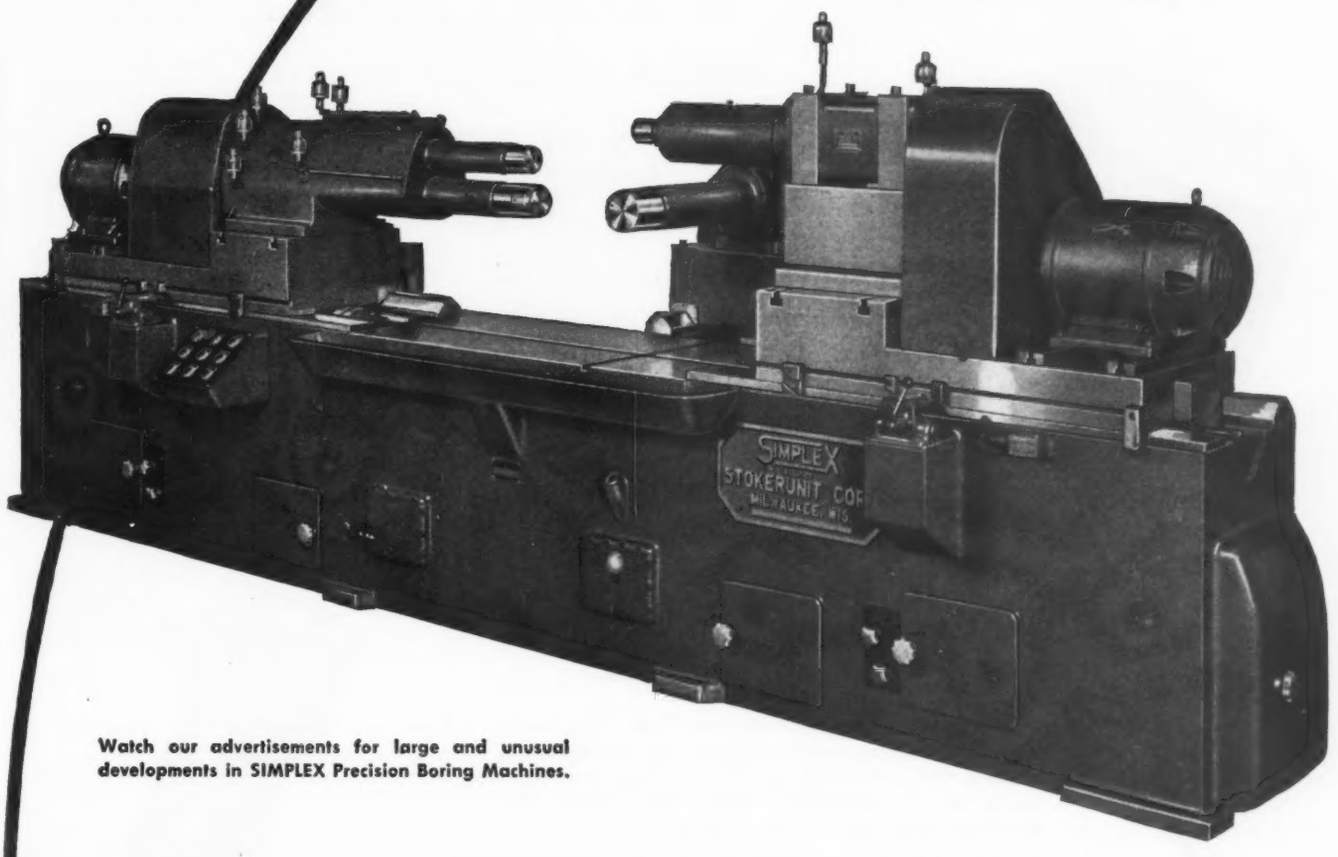
PLEASE WRITE FOR CATALOG

THE HEIM COMPANY
FAIRFIELD CONNECTICUT

SIMPLEX

When a leading tractor manufacturer contracted to build a transmission for a military tractor, they realized they could not take any chances with Government inspection. A SIMPLEX 3U 3-way Precision Boring Machine, large enough to bore a unit 4' long, made a quick and easy job of getting them out swiftly — and right!

The transmission case was approximately rectangular, 48" long, 19" wide and 21" high. There were six bores, ranging from 2¾" to 6½". Most of them were located so deep in the casting that extension type spindle heads were necessary. With this arrangement there was very little tool overhang, accuracy was easily maintained, tool life increased, chatter avoided.



Watch our advertisements for large and unusual developments in SIMPLEX Precision Boring Machines.

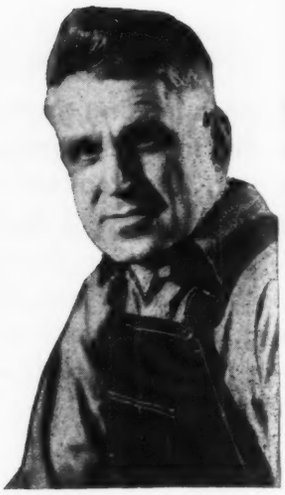
Precision Boring Machines

STOKERUNIT CORPORATION

SIMPLEX Precision Boring Machines and Planer Type Milling Machines

4526 West Mitchell Street, Milwaukee 14, Wisconsin

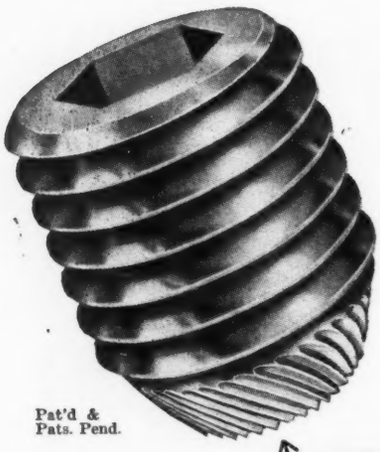
MACHINERY MAINTENANCE IS A CINCH, NOW WE'RE USING THE SET SCREWS WITH "THE THIRD FEATURE"



UNBRAKO

Reg. U. S. Pat. Off.

Socket Set Screw with Knurled Point



Pat'd & Pats. Pend.

KNURLED POINT

. . . AND HERE ARE THE 3 FEATURES

1st — Strength . . . unbelievably strong

2nd — Accuracy and hardness

3rd — Self-Locking . . . they won't shake loose

Yes, the "Unbrako" Socket Set Screws with Knurled Points are SELF-LOCKERS, because the knurled points dig-in and hold firm. It's the Set Screw with a "third feature" because of those knurled points — can't be shaken loose by even the most stubborn vibration! Yet, it can easily be backed-out with a wrench and used again and again.

Knurling of Socket Screws originated with "Unbrako" in 1934.

KNURLED "UNBRAKO" SOCKET CAP SCREW

The Head is Knurled

The Knurled "Unbrako" Socket Head Cap Screw is a time- and money-saver, because its knurled head provides a slip- and fumble-proof grip, even for oily fingers so it can be screwed-in faster and farther before it becomes necessary to use a wrench.

Both screws in sizes from No. 4 to 1½" in diameter; full range of lengths. Write today for the free "Unbrako" Catalog. "Unbrako" and "Hallowell" products are sold entirely through distributors.

KNURLED HEAD

OVER 43 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 22

BRANCHES: BOSTON • CHICAGO • DETROIT • INDIANAPOLIS • ST. LOUIS • SAN FRANCISCO

HEAVY CYLINDRICAL PARTS CHUCKED

✓ *Faster*
✓ *More Accurately*
✓ *With Less Effort*

USING *"LOGAN"*

1. **Air Operated Collet Chuck**
2. **Rotating Air Cylinder**
3. **Foot Operated Air Control Valve**
4. **R-F-L Unit** (air regulator-filter-lubricator)

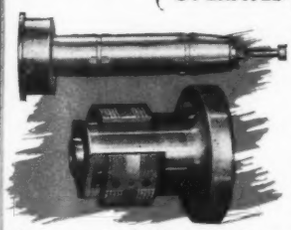
Heavy, bulky 155 mm. shell casings are accurately centered and quickly chucked for finishing operations by means of a Logan air operated collet-type chuck and a complete Logan air system. Air power and the handy foot operated valve leave the operator's hands free, and save his time and energy for work requiring high manual skill.

This operation involves hand finishing of tool marks and other surface irregularities to meet close inspection for accuracy and finish. Constant parallel gripping contact is assured because the master jaws are positioned in the taper bore by compression springs—an exclusive Logan collet chuck feature. Loading, chucking and unloading of the unwieldy workpiece require only 45 sec.

A wide range of cylindrical work can be held on standard Logan air or hydraulic operated collet chucks, manufactured to fit American standard spindle nose specifications. Logan also offers a complete line of air and hydraulic operated chucks in these types:

1. 2 and 3-jaw universal and combination chucks.
2. Dual purpose 2-in-1 chucks.
3. 4-jaw duplex chucks.
4. Compensating finger-type chucks.
5. Compensating jaw-type chucks.
6. Indexing jaw-type chucks.

LOGAN { AIR AND HYDRAULIC OPERATED } MANDRELS



DESIGNED and BUILT FOR SPECIFIC APPLICATIONS

Logan also offers expanding mandrels for holding work not suited to external chucking. The long 6-jaw mandrel illustrated provides rigidity and uniform support for long tubular parts of unusual weight or thin-walled section, thus permitting precision turning, grooving, facing, etc. The short 3-jaw mandrel holds relatively shallow work that cannot be chucked externally because of thin section or projections such as flanges, bosses and fillets. Send details of your problems for free analysis and recommendations.

LOGAN ENGINEERING HELP

Consult Logan engineers for advice on how to obtain higher accuracy and finish—reduce chucking time—and minimize operator fatigue with air and hydraulic operated chucks and mandrels. There is no obligation for this service.

Write for these FREE CATALOGS

Get complete information on Logan air and hydraulic operated chucks—write for Catalog 70, Section L. Also ask for information on Logan rotating air and hydraulic cylinders, air valves, hydraulic valves, the R-F-L unit (air regulator-filter-lubricator), and hydraulic power units.

Logan SAVES ★TIME ★EFFORT ★MOTION

Air and Hydraulic Equipment

LOGANSPORT MACHINE CO., INC.

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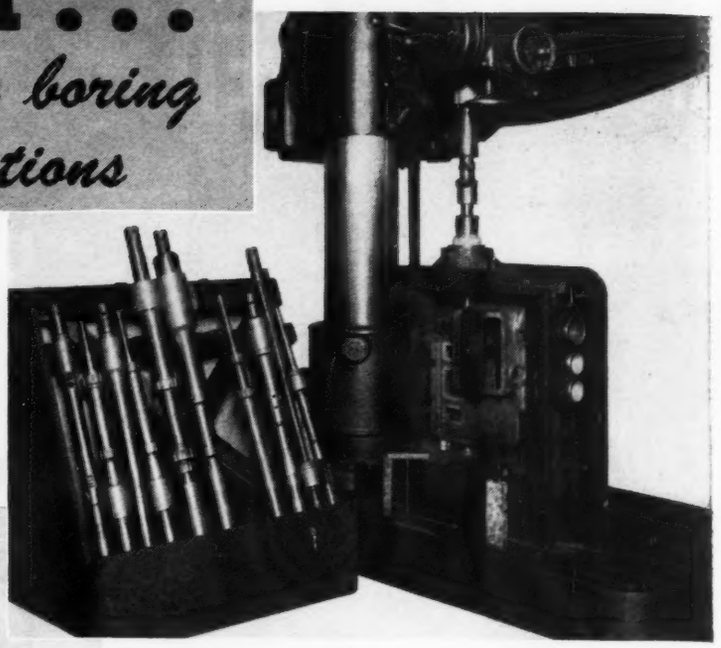
LOGANSPORT
INDIANA

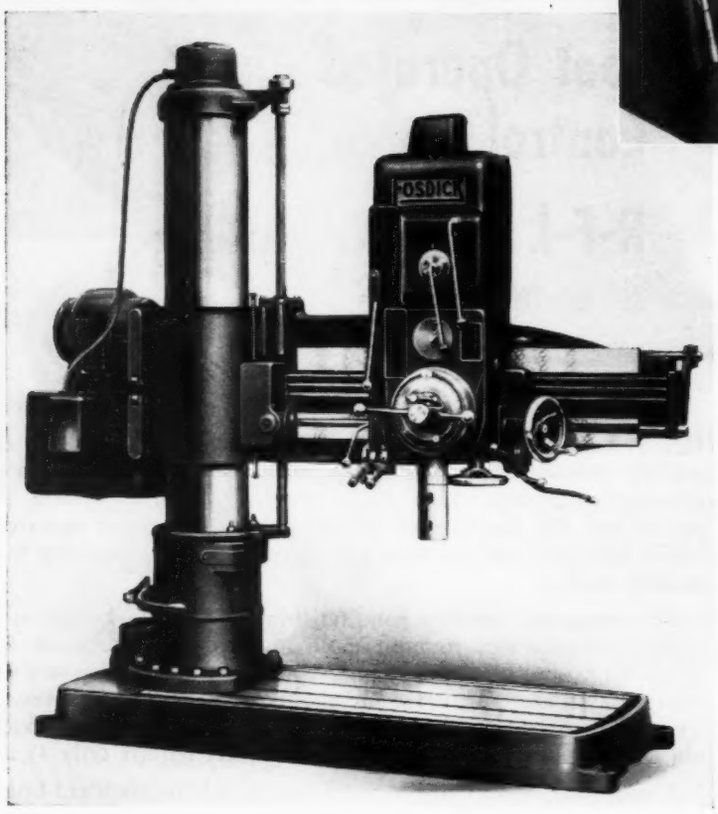
CHUCKS • CYLINDERS • VALVES • PRESSES • SURE-FLOW COOLANT PUMPS

RIGIDITY...

to handle Precision boring and reaming operations

FOSDICK *Hydraulic* RADIAL





● Rigidity of base – column – and arm construction permit precision boring and reaming operations on the Fosdick Hydraulic Radial.

Shown is a typical job—with the tools required to complete the operations. One 4⅜" hole and two 3⅛" holes are bored and reamed horizontally while one vertical 4⅜" hole is bored and reamed to close tolerances. The universal joint attachment permits boring bars to float insuring accurate work and perfect alignment. The job is completed in 5 hours and 50 minutes.

Although your job may only require an ordinary drilling operation this work demonstrates the versatility of the machine.

★

For accuracy—range—and low cost production put your radial drill work on a Fosdick Hydraulic Radial.

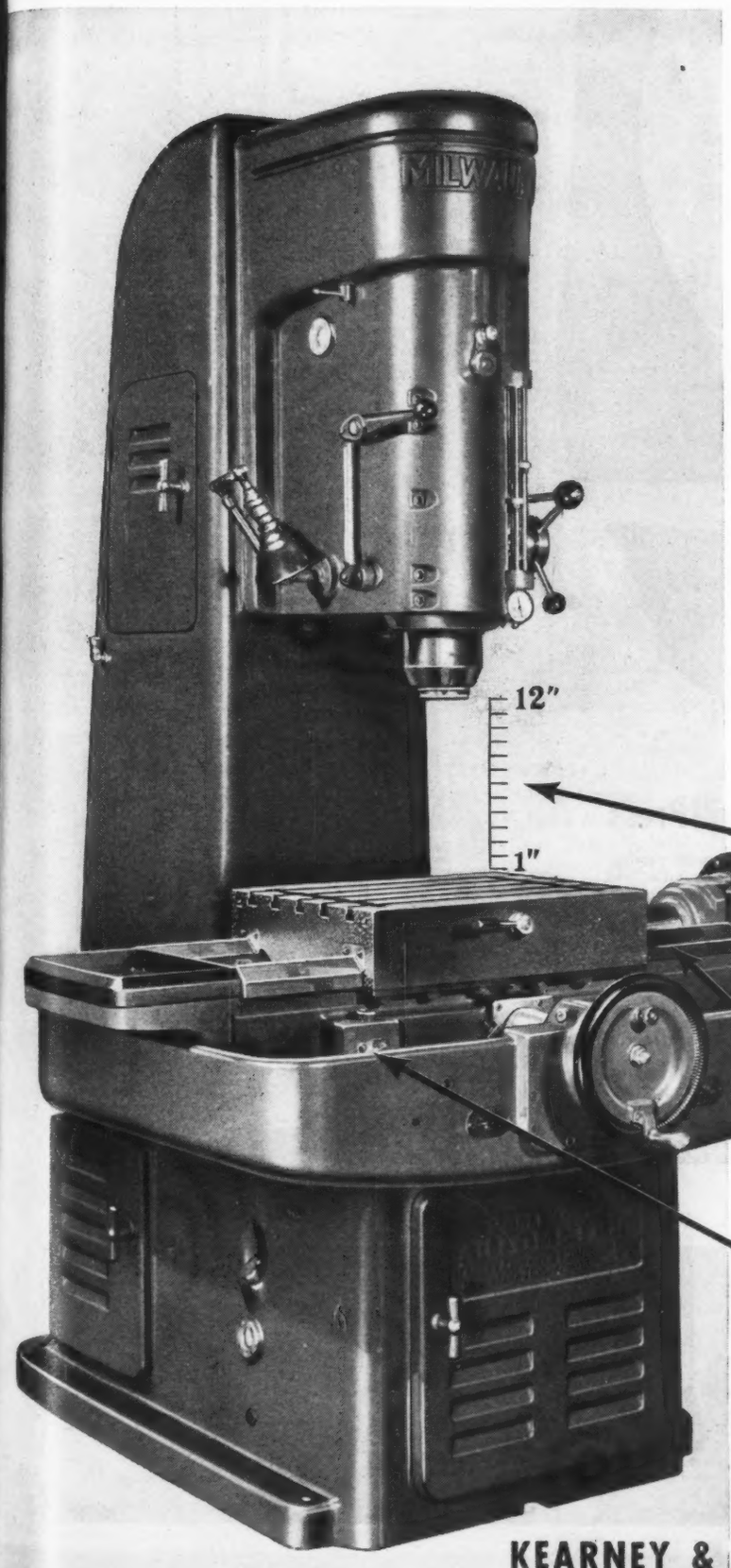
Complete details available in Fosdick Radial Drill bulletin M.R.

★

FOSDICK MACHINE TOOL COMPANY
CINCINNATI 23. . . . OHIO

When You Do Precision Boring .You Can Depend On

THREE DIMENSIONAL ACCURACY!



Positive Alignment of Kearney and Trecker's Autometric Boring Machine Gives You Unerring 3-Way Accuracy for all Precision Boring Operations!

RUGGED CONSTRUCTION . . . precision engineering and design . . . simplicity of operation — these are the basic features of Kearney & Trecker's Model C Autometric Boring Machine which give you positive unsurpassed accuracy for toolroom, laboratory or production precision boring operations!

For example, not only are the longitudinal and transverse movements of the table accurate within a maximum tolerance .0002 inch in any 12 inch at the table top — but this same high degree of accuracy is maintained at all levels up to an elevation 12 inch *above the table top!*

Look to Kearney & Trecker's Model C Autometric for the modern answer to your precision boring problems — write today for catalog No. CMA10.

1. VERTICAL ACCURACY

Base, column and guard cast in one piece to form a solid, rigid foundation and backbone for the entire machine, assure precise alignment at all times. Longitudinal and transverse movements of the table are accurate within a minimum tolerance of .0002 inch in any 12 in. of length at all levels up to 12 in. *above the table top.*

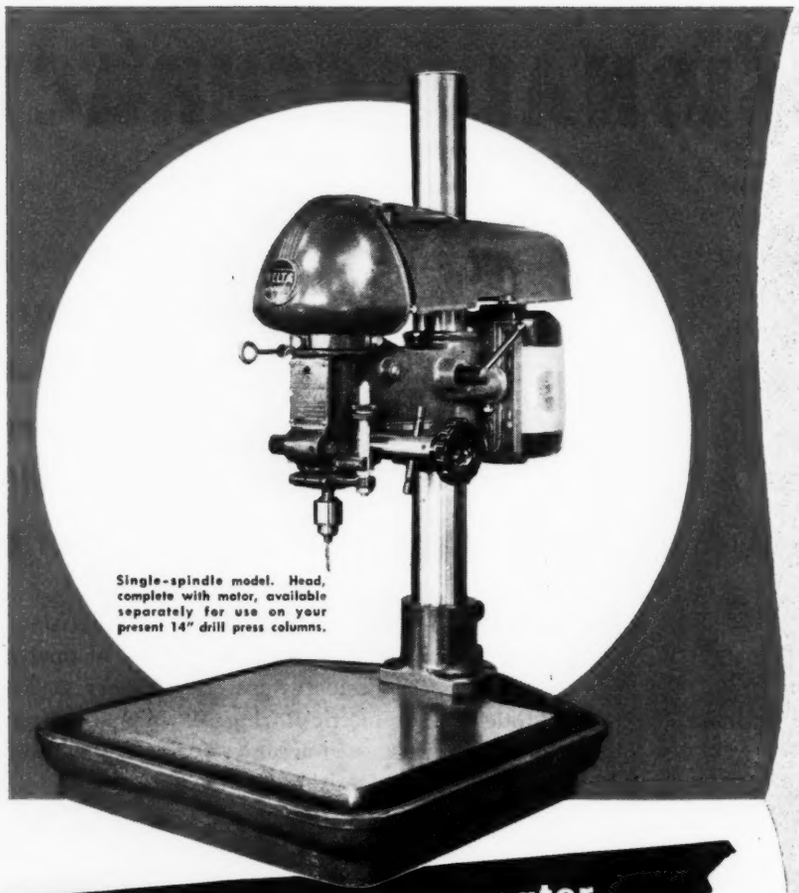
2. LONGITUDINAL ACCURACY

Table is mounted on accurately ground ways and positioned by a precision screw which assures longitudinal accuracy at all work elevations above the table.

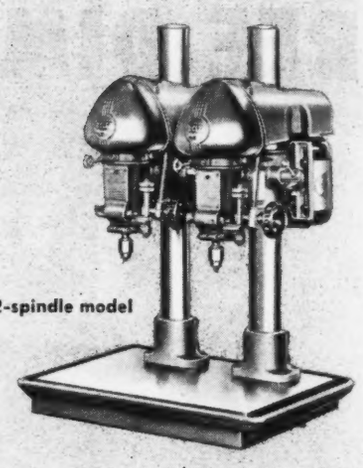
3. TRANSVERSE ACCURACY

Saddle is also mounted on accurately ground ways and positioned by a precision screw thus maintaining transverse accuracy at all work elevations. All alignments affecting accuracy of the workpiece are held to within a non-accumulative error of .0002 inch in any 12 inches.

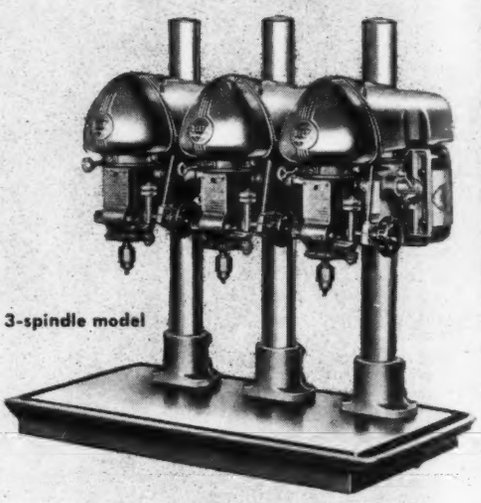
KEARNEY & TRECKER PRODUCTS CORPORATION
MILWAUKEE 14, WISCONSIN



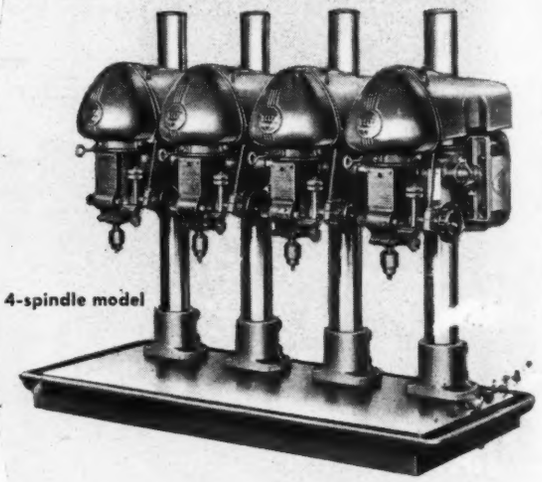
Single-spindle model. Head, complete with motor, available separately for use on your present 14" drill press columns.



2-spindle model



3-spindle model



4-spindle model

A low-cost tool for greater accuracy on sensitive drilling from .025" to 1/4" diameter...

Delta-Milwaukee Super-Hi-Speed Drill Press

Embodies all the well-known construction features and operating advantages of other Delta-Milwaukee drill presses

Now — a high-speed drill press by Delta-Milwaukee, for greater precision on small-hole drilling of plastics, aluminum, and other metals. Drills to the center of a 14" circle.

Famous Delta-Milwaukee features include: Lubricated-for-life ball bearings, double-sealed against harmful abrasive dust . . . Preloaded ball bearings . . . Precision-ground spindles . . . Dynamically-balanced pulleys . . . Dynamically-balanced motor . . . Specially-selected Jacobs chuck.

Single-spindle model, with production table. 2-spindle, 3-spindle, and 4-spindle models, with sectional tables. Head, complete with motor, available separately for special set-ups. Three-step pulley permits spindle speed range of 12,000 . . . 8000 . . . 5000 R.P.M. Full spindle travel is 2¼".

See your nearby Delta industrial distributor for the complete story on the new Delta Super-Hi-Speed Drill Press.

Send for free catalog that pictures and describes the entire line of compact, portable, low-cost Delta-Milwaukee Machine Tools. Use coupon below.

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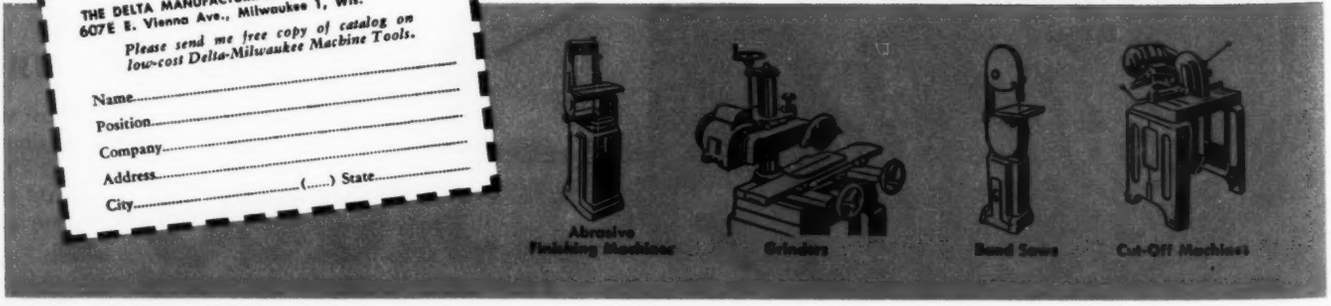
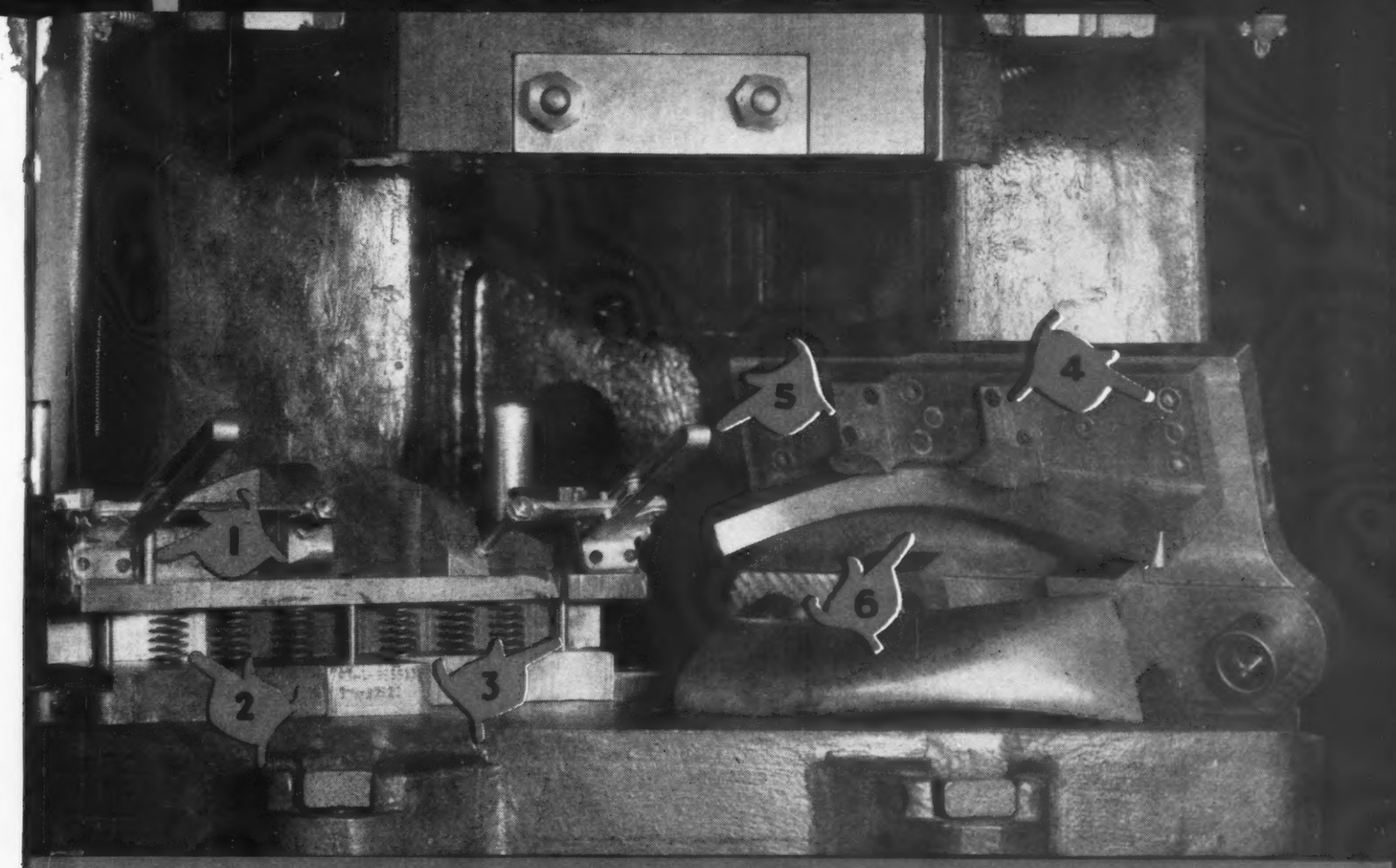


Abrasive Finishing Machines | Grinders | Band Saws | Cut-Off Machines



THE 6 DANLY PRODUCTS IN THIS PICTURE

FIT INTO MANY PLACES IN YOUR PICTURE

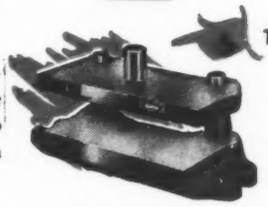
DANLY PRECISION DOWEL PINS have a big job to do in the Steel, Non-ferrous metals and Plastic Industries. Accurate through their length, there will be no expensive re-drilling and reaming, because Danly Precision Dowel Pins are diamond tested for hardness and ground to a tolerance of one-ten thousandth of an inch . . .

DANLY DIE SPRINGS are noted for *staying power*. The repeated pressure of the ram many times every hour induces fatigue that will snap ordinary die springs—and that means tearing down the whole setup. Two complete lines. *MEDIUM PRESSURE—HIGH DEFLECTION; HIGH PRESSURE—MEDIUM DEFLECTION.*

DANLY SOCKET-HEAD STRIPPER BOLTS incorporate the same advantages as the Danly Knurled Socket-Head Cap Screws. Busy fingers don't slip on the knurled head . . .

DANLY KNURLED SOCKET-HEAD CAP SCREWS save time and money. Here's why: Oily fingers readily grasp the knurled head—the mechanic can drive it a good part of the way by hand before using the wrench. Infinite applications—a wide range of sizes . . .

DANLY KWIK-KLAMP TOGGLE CLAMPS are versatile, all-around utility clamping tools. Strong construction combined with simplicity of operation makes Kwik-Klamps a must wherever quick, positive clamping action and known pressures are desired . . .



THE DANLY DIE SET needs no introduction. A *must* for precision stamping, Danly die sets are once more paving the way to that new washing machine and electric iron in every home—that new car in every garage . . .

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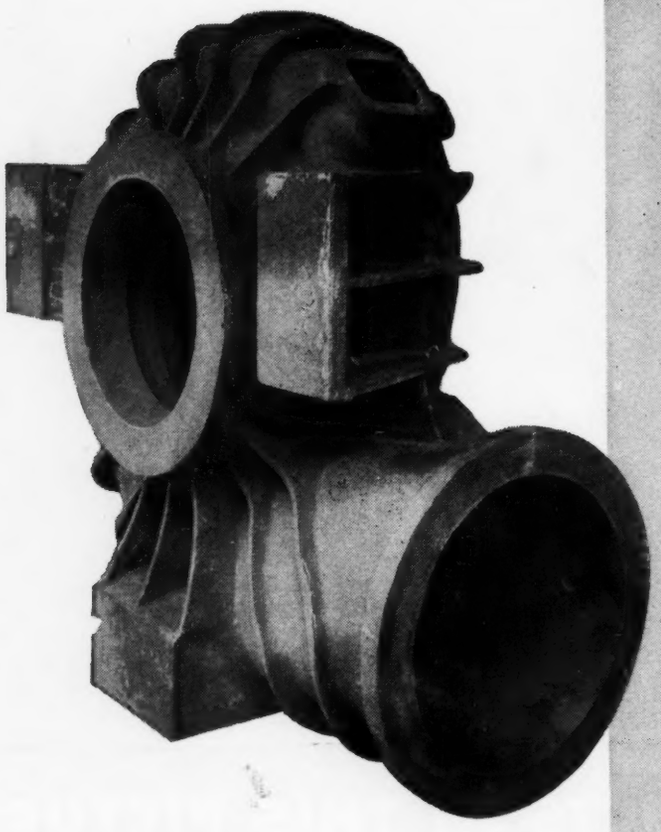
Danly Tool, Die and Gage Makers' Supplies



Doing many things WELL!

Do you need an intricate casting like this pump volute, that calls for the highest skill in pattern making, plus expert modern foundry practice? Cramp Division of Baldwin can make it for you.

Do you need a casting like this die block with special properties in the metal to give unusual service qualities? Cramp can make it for you.

Cramp has spent 118 years learning how to do many difficult foundry jobs unusually well. Nineteen nonferrous alloys, and 14 ferrous alloys offer a wide variety of properties. Foundry facilities permit quantity production of small castings, and the speedy production of large ones. Any size from ounces to 100,000 lbs. can be produced. Ask for Bulletin 194. The Baldwin Locomotive Works, Cramp Brass & Iron Foundries Division, Philadelphia 42, Pa., U. S. A. Offices: Philadelphia, New York, Chicago, Washington, Boston, Cleveland, St. Louis, San Francisco, Houston, Pittsburgh, Birmingham.

CENTRIFUGAL PUMP VOLUTE, cast of Cramp Alloy No. 257. This is a difficult and exacting job, but it's all in the day's work at Cramp.

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DIE CASTING. Made of Cramp Iron Alloy No 263, which permits a maximum number of clean stampings to be obtained. No. 263 is also a favorite for die inserts.

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If you need fabricating bar alloy stock now and are willing to adapt top quality material priced at or near carbon steel prices—here is real opportunity. Over 25,000 tons of hot rolled and 25,000 tons of cold finished carbon and alloy steel bars are ready for immediate shipment to you. The stock is available in standard sizes, shapes, but is of above average grades. Accordingly it has been priced at levels such as to insure its quick employment to meet America's postwar needs. For details on F.O.B. locations, sizes, quantities and shipping arrangements contact your nearest W. A. A. Regional Office below . . . or clip and mail this coupon.

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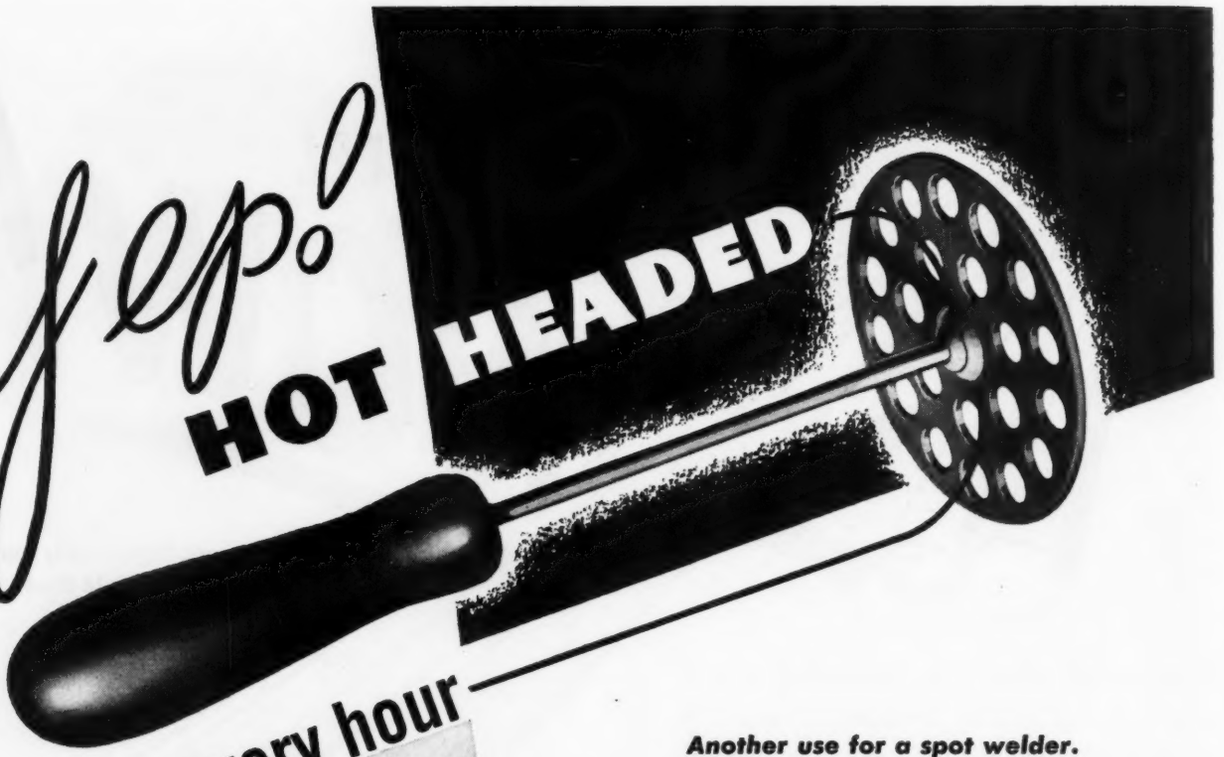
Yep! HOT HEADED



600 every hour

The operator joins a solid ¼" steel rod to a die-stamped, cold-rolled steel plate by "hot-heading" on a Taylor-Winfield "C" type Spot Welder . . . at the rate of 10 every minute. Produced by Merit Products Co., Niles, Ohio.

Another use for a spot welder.

The production rate on this potato masher explains why production men use spot welders for fabricating boxes, panels, frames, grill work, wire products, kitchen ware, automotive parts, radio cases, agricultural tools . . . in fact almost any product requiring the joining of metal.

One man operating one Taylor-Winfield Spot Welder at Merit Products Co., Niles, Ohio, completes 600 potato mashers every hour. That's 10 strong, sturdy mashers every minute.

Picture now your own product and visualize what 2, 5, 10, 15, or 50 men or women can do with an equal number of Taylor-Winfield Spot Welders.

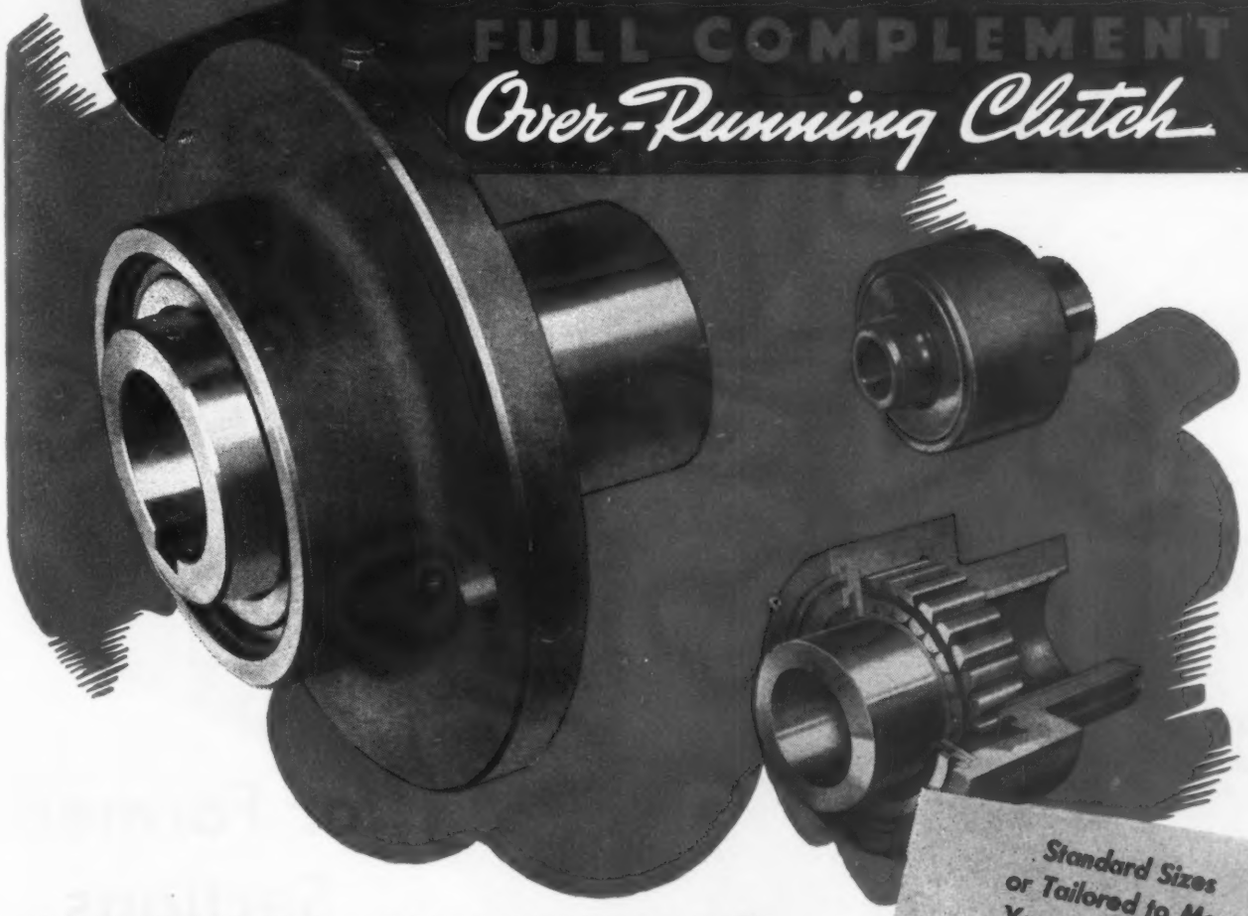
Get the full production story of spot or the other forms of resistance welding (seam, flash-butt, and projection) ***from a Taylor-Winfield representative . . . available through letter or phone call.*** He'll help you put the joining of metals on a low-cost, production basis.

Taylor-Winfield Spot Welders are used for the welding of clean and coated carbon steels, stainless steels, and weldable alloys of aluminum, nickel, copper, and magnesium. Available in foot, air, or motor operated types in many models and sizes. Shown—"C" type, foot-operated.

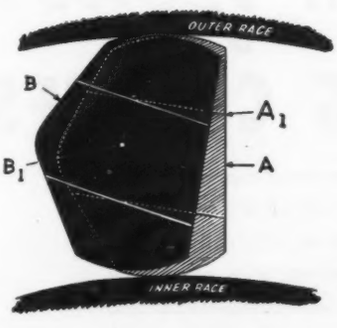
The TAYLOR-WINFIELD CORPORATION

WARREN . . . OHIO

CENTRIFUGALLY CONTROLLED FORMSPRAG FULL COMPLEMENT Over-Running Clutch



FRICTIONLESS OVER-RUNNING



At selected speeds, centrifugal force overcomes the force of the energizing spring and establishes an actual clearance between sprag and inner race. Sprags contact both races again when speed drops to the selected R.P.M.

When centrifugal force, acting on the center of gravity B_1, exceeds the energizing action of the spring, the sprag takes position B, completely clearing the inner race and permitting free running.

As speed decreases, the energizing action of the spring, exerted at A_1, exceeds centrifugal force and the sprag returns to position A, in contact with both inner and outer races.

Sprag design and spring tension permit the clutch to function at predetermined speeds. In the arrangement shown, centrifugal throw-out occurs when the speed of the outer race and sprags exceeds that of the inner race.

Standard Sizes or Tailored to Meet Your Requirements

Formsprag is available in a wide range of capacities, both plain and ball bearing types.

Formsprag is delivering outstanding performance on spring coilers, printing presses, rubber and paper calenders, punch press feeds, dual power drives, logging, hoisting, textile weaving and wrapping machinery.

Standard sizes meet many conditions, but if your product requires special clutches our engineering division is equipped to design the proper clutch to meet your requirements.

Please give full information when writing—a description of the operation, normal and maximum torque at specified speeds, the number of times per minute the clutch engages and disengages, and other information pertinent to the installation.

ARMY E NAVY

Illustrated literature, including capacity ratings of all standard sizes, available on request.

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on Strip, Bar

or Formed Sections with *Yoder* FLYING CUTOFFS

The variety of sections you can cut at speeds up to 200 feet per minute with Yoder cutoff machines is as varied as your needs. Angles, tees, simple channels or intricate mouldings or conduit, all are cut cleanly and accurately with steel dies mounted on a movable table. Ideally used in team with roll forming machines producing sections from strip stock. Also used to straighten or cut tubing, wire or rod, or fitted with dies or punches for perforating or embossing. Let us send you a booklet with complete details.

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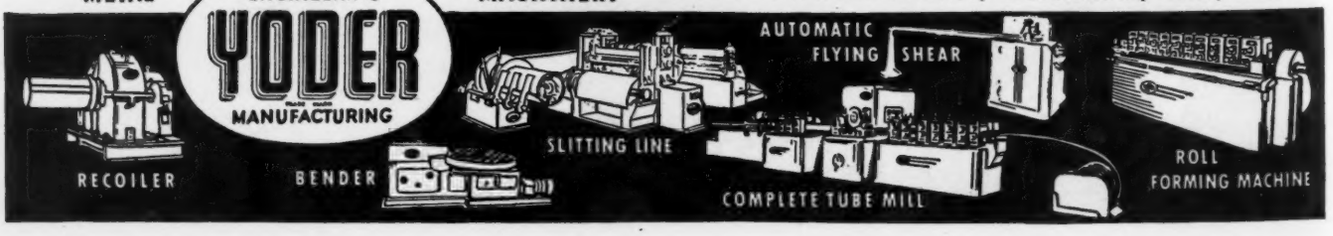

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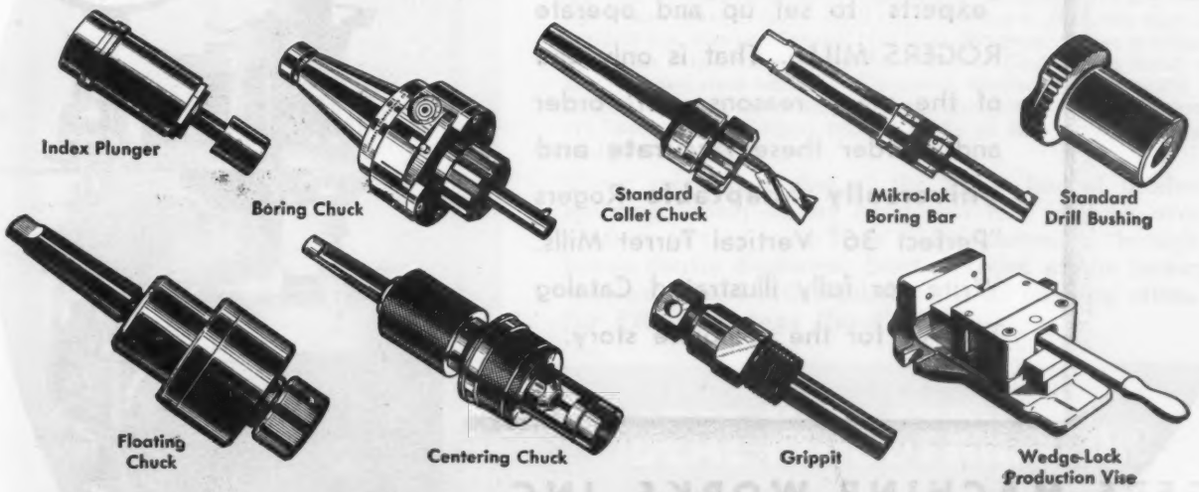
No slow, trial-and-error methods of setting cutting tools with the Universal Mikro-Lok Boring Bar! Tools are quickly and easily set to within .0005" accuracy by micrometer dial. Will repeat size within .0002". Exclusive Mikro-Lok arrangement securely grips tools at extreme end of bar for accurately boring diameters as small as ½". Precision manufacturing and assembling of adjusting nut and wedge holds dial backlash to minimum: heat treating of all parts assures maximum resistance to wear. For light-rough, semi-finish, and finish boring of all types—including boring to bottom of blind hole, boring to a shoulder, or taking intermittent cuts—make Universal Mikro-Lok Boring Bars standard equipment in your plant. Write for complete information.

UNIVERSAL TOOLS THAT WILL INCREASE PRODUCTION AND EFFICIENCY IN YOUR PLANT.



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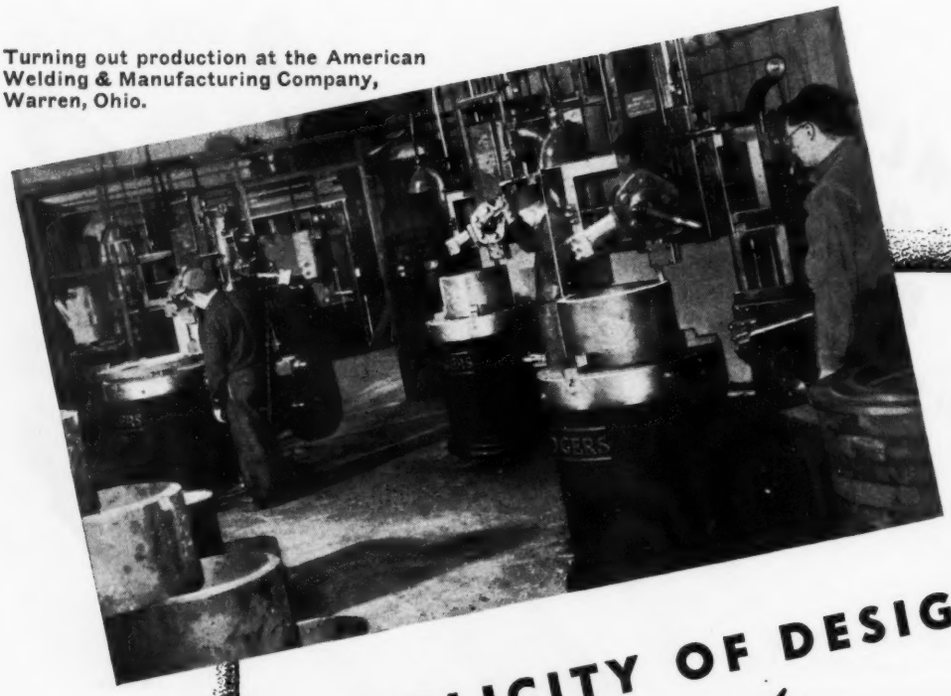

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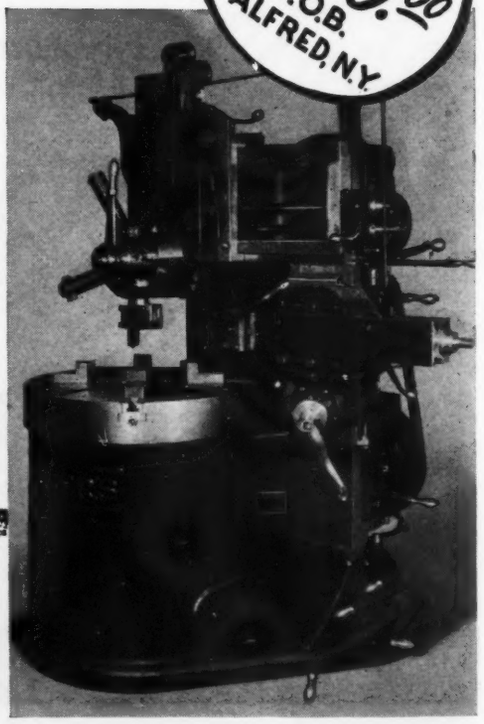

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Three million dollars worth of surplus Hobart Arc Welders *must* be sold between May 15th and June 15th. Most of this equipment is of the MG type but some quantity is available in gasoline driven units. Arrangements may be made to inspect the offered items. Largest inventories are located at Boston, Detroit, Cleveland, Chicago, Atlanta, Kansas City, Richmond and Philadelphia—but information on availability, condition and location may be obtained at any of the War Assets Administration Regional Offices listed below. The equipment will be sold on a "where is, as is" basis . . . used or unused . . . and priced accordingly. For full information contact the nearest office listed below or check and mail this coupon.

ALSO MANY OTHER TYPES OF WELDING AND FLAME CUTTING EQUIPMENT

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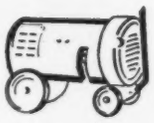
WESTINGHOUSE

Flexarc equipment for production or construction operations is available in smaller quantity. Also other standard makes and ratings.



RESISTANCE WELDERS

Spot Welders located in Philadelphia, Detroit, Chicago, Los Angeles, Cleveland and Kansas City; *Seam Welders* in Cleveland, Chicago, Detroit, Birmingham, Boston and Philadelphia. Also *Flash Welders.*

WELD POSITIONERS

In standard sizes and types, are located in Detroit, Boston, Chicago and New York.

FLAME CUTTERS

Save production time and money with portable or stationary, single or multiple torch flame cutting machines. All types of gas cutting equipment available for quick sale.

VETERANS OF WORLD WAR II—To help you in purchasing surplus materials, a veterans' unit has been established in each War Assets Administration Regional Office.

FREE SALE FACTS

To War Assets Administration:
Please send me information prior to your sale on the availability, condition and location of Hobart Arc Welders of the following

types:..... and ratings:.....

.....

.....

I am also interested in:—

- ☐ LINCOLN ARC WELDERS
- ☐ SPOT, SEAM, FLASH WELDERS
- ☐ WESTINGHOUSE ARC WELDERS
- ☐ WELD POSITIONERS
- ☐ .....ARC WELDERS (other)
- ☐ FLAME CUTTERS

Name.....

Firm.....

Address.....

City..... State..... 176-2

All items subject to prior sale

WAR ASSETS ADMINISTRATION

OFFICES LISTED BELOW ARE TEMPORARILY IN RECONSTRUCTION FINANCE CORPORATION AGENCIES

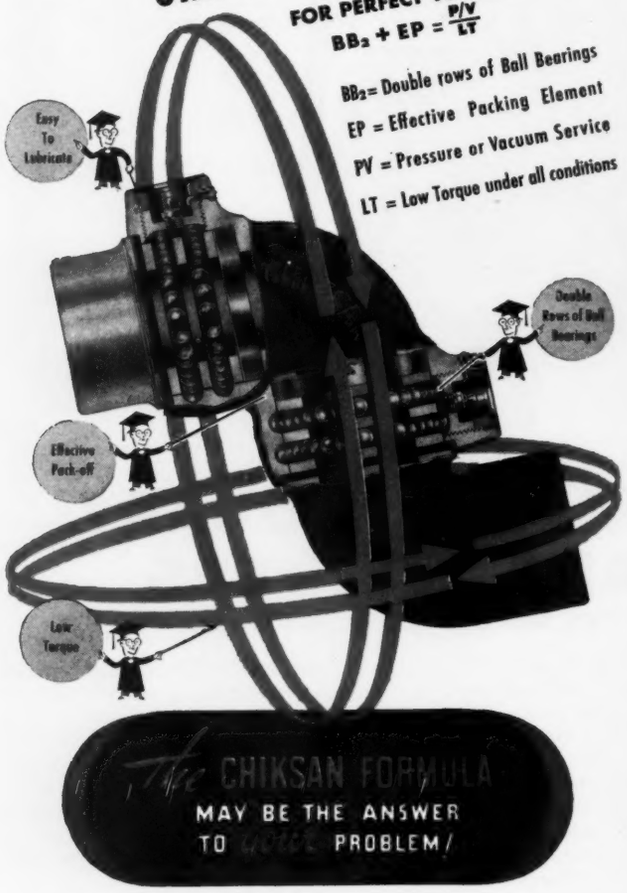
Offices located at: Atlanta · Birmingham · Boston · Charlotte · Chicago · Cleveland · Dallas · Denver Detroit · Helena · Houston · Jacksonville · Kansas City, Mo. · Little Rock · Los Angeles · Louisville Minneapolis · Nashville · New Orleans · New York · Oklahoma City · Omaha · Philadelphia Portland, Ore. · Richmond · St. Louis · Salt Lake City · San Antonio · San Francisco · Seattle · Spokane Cincinnati · Fort Worth (Telephone 3-5381)

CHIKSAN FORMULA

FOR PERFECT FLEXIBILITY

$BB_2 + EP = \frac{P/V}{LT}$

BB_2 = Double rows of Ball Bearings
EP = Effective Packing Element
PV = Pressure or Vacuum Service
LT = Low Torque under all conditions



The CHIKSAN FORMULA
MAY BE THE ANSWER
TO [illegible] PROBLEM/

Chiksan flexibility is so precisely engineered that the elements which provide for easy turning and perfect seal under pressure or vacuum can be stated in a few simple symbols. This streamlined design, expressed in precision manufacture, has won world-wide acceptance for Chiksan Ball-Bearing Swivel Joints wherever movement or rotation is required in pipe lines handling liquids, vapors and gases... in aircraft... electronics... railroads ... chemical and food processing plants... refineries... marine installations... open hearth furnaces and rolling mills... and hundreds of other applications. The new Chiksan Catalog illustrates and describes over 500 different Types, Styles and Sizes. Your Engineering Department should have a copy for ready reference.

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EXPORT SALES: Chiksan Export Company, Brea, California.
Branches: NEW YORK, 7 • HOUSTON, 2

CHIKSAN TRADE MARK REG. BALL BEARING SWIVEL JOINTS FOR ALL PURPOSES
CHIKSAN COMPANY BREA, CALIFORNIA
NEW YORK HOUSTON

CRITERION *Boring* HEADS

Accuracy Accepted

Extremely high accuracy is a standard feature of Criterion Boring Heads. Moreover, original accuracy is maintained far beyond normal expectation. Lead Screw is ground from solid AFTER hardening. Shanks interchangeable. Criterion Heads are in use throughout the nation. Order from your dealer. Request free literature.

CRITERION
MACHINE WORKS
BEVERLY HILLS, CALIFORNIA

A distressed little man from Blastocket
Spent much of his time
wrenching sockets
He mislaid 'em and lost 'em
or jumbled and tossed 'em
'Cause he couldn't keep all in his pockets
Still his partner in business
had worse fits
For his tool box was all jammed
with screw bits
Now both men are wiser
This sign's their adviser
Use HALLOWELL Compact
SPEED TOOL KITS
SOCKET WRENCH KIT
HALLOWELL
HALLOWELL

"SOCKET SCREW" KIT†

with interchangeable bits

"SOCKET WRENCH" KIT†

with interchangeable sockets

Molded Celanese* Plastic Handles

Handy little kits with all the bits and wrenches you'll need for most jobs. And, there is the same quality and precision in the manufacture of these kits as in every other Standard product.

A hollow handle holds interchangeable tools; there is a *swivel bit-chuck* for better leverage and for reaching difficult places. The tools, made of special high-grade alloy steel, were carefully chosen for their usefulness; handles are of famous Celanese* Plastic for durability.

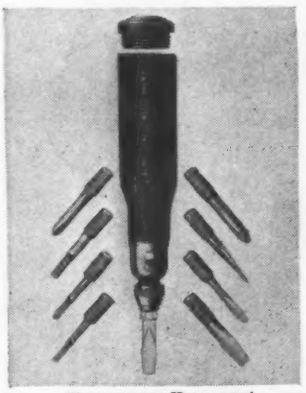
"SOCKET SCREW" KIT† #25, with swivel head drive, contains 8 tools: 6 hex bits: 1/16", 5/64", 3/32", 1/8", 5/32", 3/16"; #1 Phillips; 1/4" flat screw driver bit.

"SOCKET SCREW" KIT† #50, with swivel head drive, contains 9 tools: 6 hex bits: 1/8", 5/32", 3/16", 7/32", 1/4", 5/16"; #2 and #3 Phillips; 5/16" flat screw driver bit.

"SOCKET WRENCH" KIT† #75 contains: 5 sockets with openings: 1/4", 5/16" (6 point hex); 11/32", 3/8" and 7/16" (12 point hex). With 1/4" square drive.

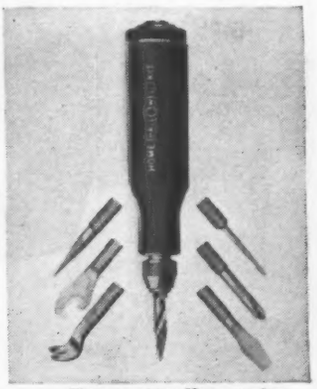
"SOCKET WRENCH" KIT† #100 contains: 6 (12 point hexagon) sockets with openings: 3/8", 7/16", 1/2", 9/16", 5/8", 3/4". With 3/8" square drive.

Obtainable at Suppliers throughout the country. If your Supplier does not carry these kits, send his name to us, along with yours, and you will be taken care of promptly.



"AUTO" KIT†

"Auto" Kits† (in two sizes) . . . contain small tools most necessary for auto maintenance, Phillips bits, clutch head bits, flat screw drivers and tapered reamer.



"HOME" KIT†

"Home" Kit† . . . contains flat screw drivers (1/16" and 1/4" wide), Phillips screw driver, tapered reamer, gimlet, tack puller and bottle cap opener.

†Pat's Pending

OVER 43 YEARS IN BUSINESS

*Reg. U. S. Pat. Off.

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 22 BRANCHES: BOSTON · CHICAGO · DETROIT · INDIANAPOLIS · ST. LOUIS · SAN FRANCISCO

USE HEADED AND THREADED FASTENERS FOR ECONOMY AND RELIABILITY

BRASS
BOLTS · NUTS
STUDS

Brass and bronze, all types—every non-ferrous metal—available in every standard dimension or to your specifications.

Better Bolts of Iron, Steel, Brass and Other Metals Since 1882.

PAWTUCKET

"THE BOLT MAN"

MANUFACTURING COMPANY

327 Pine Street • Pawtucket, R. I.

THE PLACE TO SOLVE YOUR BOLT PROBLEMS

Announcing the

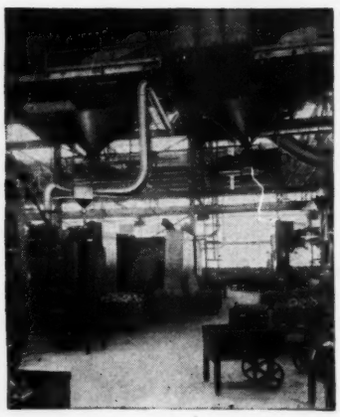
SCHNEIBLE VELOCITRAP

IT DOES THESE 4 THINGS

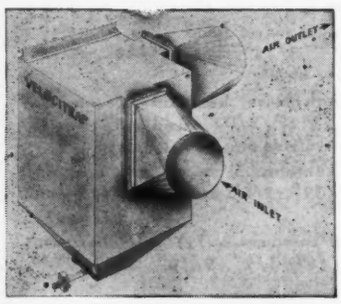
- ✓ *Salvages Valuable Material*
- ✓ *Recovers Material Dry*
- ✓ *Stops Settling Out of Heavy Material*
- ✓ *Eliminates Wear in Duct System*

Where the dust from a process has a recovery value, the Velocitrap provides a simple, practical and economical means of salvage.

The contaminated air removed by a dust control system is carried through the Velocitrap, where the bulk of the solids, including the heavier particles, are trapped in a dry state; ready to be returned to process.



Abrasive materials, which wear out the elbows of the ducting prematurely, are removed; resulting in longer life for ducting and collectors. Settling out of heavy materials in the duct lines is eliminated.



Send for Bulletin 246.

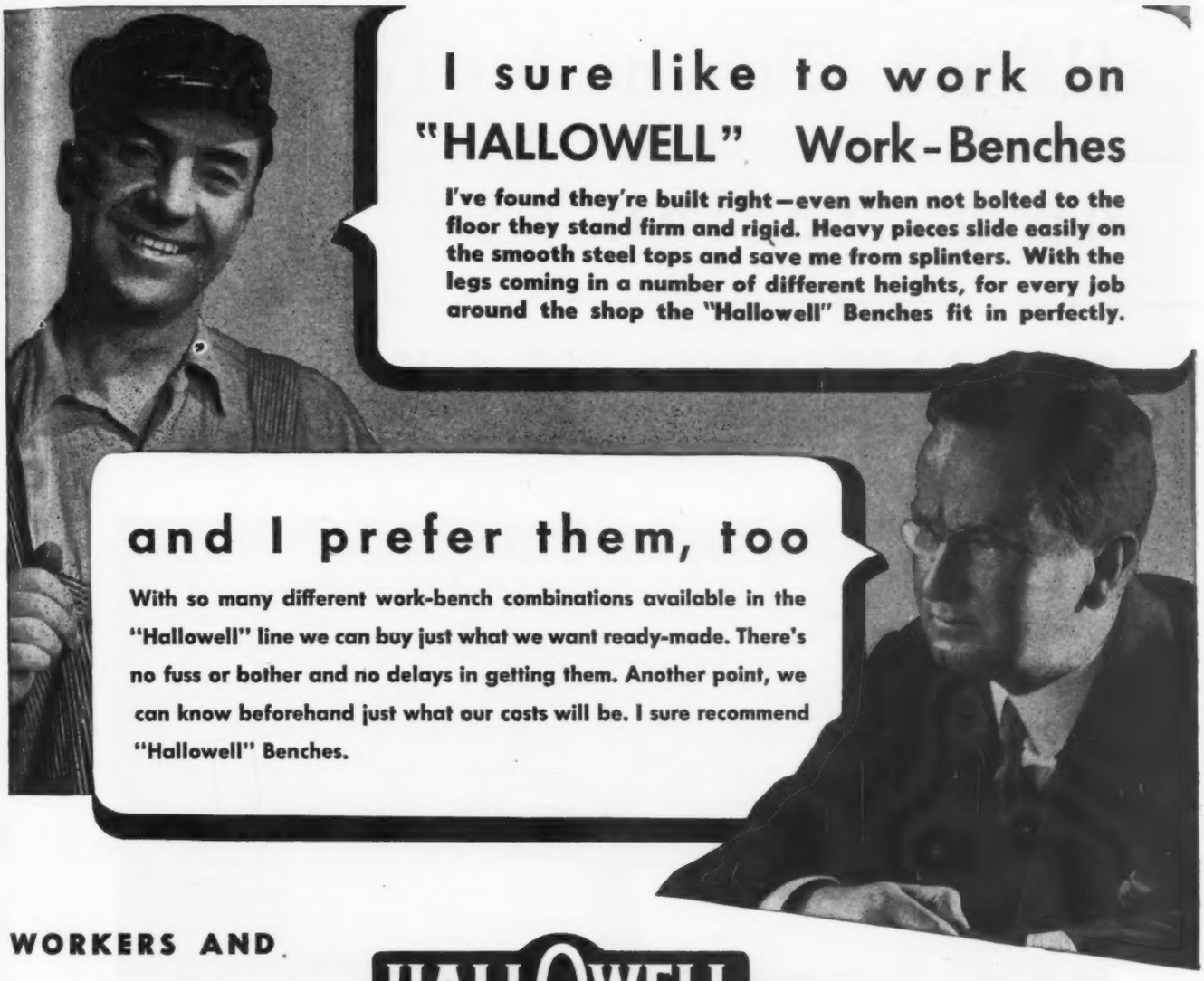
Schneible Velocitrap. Dry solids, air-borne at high velocity are ejected by centrifugal force from specially designed ports in the unit, becoming trapped in a hopper.

CLAUDE B. SCHNEIBLE CO.

2827 Twenty-fifth St. Detroit 16, Mich.

Engineering Representatives in Principal Cities

SCHNEIBLE



I sure like to work on "HALLOWELL" Work-Benches

I've found they're built right—even when not bolted to the floor they stand firm and rigid. Heavy pieces slide easily on the smooth steel tops and save me from splinters. With the legs coming in a number of different heights, for every job around the shop the "Hallowell" Benches fit in perfectly.

and I prefer them, too

With so many different work-bench combinations available in the "Hallowell" line we can buy just what we want ready-made. There's no fuss or bother and no delays in getting them. Another point, we can know beforehand just what our costs will be. I sure recommend "Hallowell" Benches.

WORKERS AND MANAGEMENT LIKE HALLOWELL WORKBENCHES

You'll find the same opinion in every shop or factory where "Hallowell" workbenches of steel are used. "It's tops", "Makes working a pleasure"... that's what they say all the way from the shop to the front office. And no wonder! For these benches are sturdy enough to withstand years of hard usage, steady enough so that they don't require costly bolting to the floor, and are available in over **1300 ready-made,** interchangeable combinations. You're always sure of getting just what you want with "Hallowell"!

Write for the free "Hallowell" Catalog, today. **"Unbrako" and "Hallowell" products are sold entirely through distributors.**

Fig. 732
Pat'd & Pats. Pend.
Drawer is extra

OVER 43 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 22

BRANCHES: BOSTON • CHICAGO • DETROIT • INDIANAPOLIS • ST. LOUIS • SAN FRANCISCO

Home Town Enterprise

on a Nation-wide scale

OTIS MAINTENANCE FOR OTIS ELEVATORS

The men and women in your local Otis office — friends and neighbors of your townspeople — are working to maintain service on Otis elevators in your locality — at standards based on nation-wide experience.

Your office and the 244 other Otis offices report regularly to headquarters on every elevator under Otis Maintenance Service, and standards for your locality are based on analyses of these nation-wide reports. If yours is a small freight elevator, it must compare favorably with 5,700 others in its class. If you have a high-speed gearless passenger installation, it is graded against more than 3,000 others in the same group.

Otis Maintenance is a service by Otis for Otis elevator owners . . . available at a flat monthly rate through your local Otis office.

Otis ELEVATOR COMPANY
OFFICES IN ALL PRINCIPAL CITIES

Where even the air is "MIKED"

Guardians of Accuracy

Sier-Bath shop in the background. The instruments shown are Michigan Tool Company, Electrical Recorder, Sine Line Involute Checker, Fellows Red Liner and Brown & Sharpe Gear Checker. Experienced craftsmen are operating the modern checking machinery, a combination that assures highest accuracy. Sier-Bath Customers may have copies of checks electrically recorded on the recorder shown here — a true certificate of accuracy.

Constant-Temperature Checking Room Insures Year 'Round Uniformity of SIER-BATH GEARS

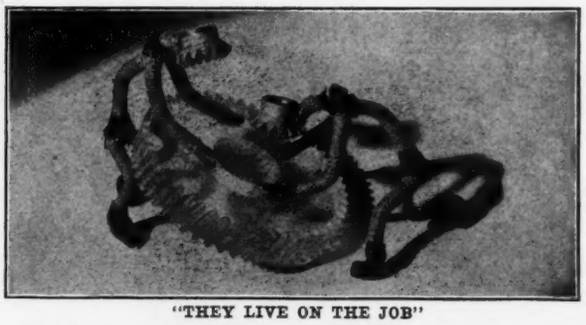
Many machine shops *claim* high dimensional uniformity for their products but Sier-Bath Gear Company *does* something about it. The checking room shown here contains such fine mechanical equipment as Hob Sharpening, Sine Line Lead and Sine Line Involute Checkers with recorders as well as indicators. To maintain dimensional uniformity in the checking equipment itself, room temperature is held to a fraction of a degree regardless of season. Thus, gear mating troubles are virtually eliminated—a gear made in December is a perfect match for its counterpart made in June. That's why Sier-Bath is your best bet for a long term contract. Write us, today.

SIER-BATH GEAR COMPANY, Inc.
9248 HUDSON BLVD., NORTH BERGEN, N. J.

Sier-Bath Gear Co. Inc.

UNUSUAL GEARS

WE MEET THE DEMANDS AS THEY APPEAR



"THEY LIVE ON THE JOB"

Mass Gears ARE UNUSUAL

Massachusetts Gear & Tool Company

34 Nashua St. Woburn, Mass.

MADE FROM ANY MATERIAL
Exactly **TO YOUR SPECIFICATIONS**

DETROIT Bevel Gear COMPANY
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SPEED REDUCERS

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CALL US LONG DISTANCE

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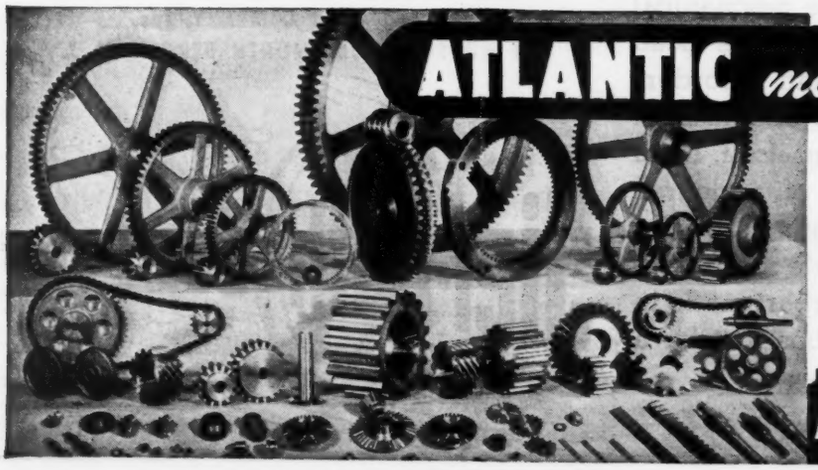

ATLANTIC *makes fine* GEARS

ANY TYPE — Spur, helical, herringbone, bevel, worm, spiral
ANY SIZE—¼" to 60"
ANY MATERIAL—Cast iron, steel, brass, bronze, Micarta
ANY QUANTITY—One gear or volume production

We are equipped for prompt service on **SPECIAL GEARS AND BREAKDOWN JOBS.** Send us blueprints or gear samples for our quotations and delivery dates.

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GEARS

FROM STOCK

Also – QUICK DELIVERY OF GEARS MADE TO YOUR SPECIFICATIONS . . . IN ANY QUANTITY.

RICHMOND HILL *Gear* WORKS

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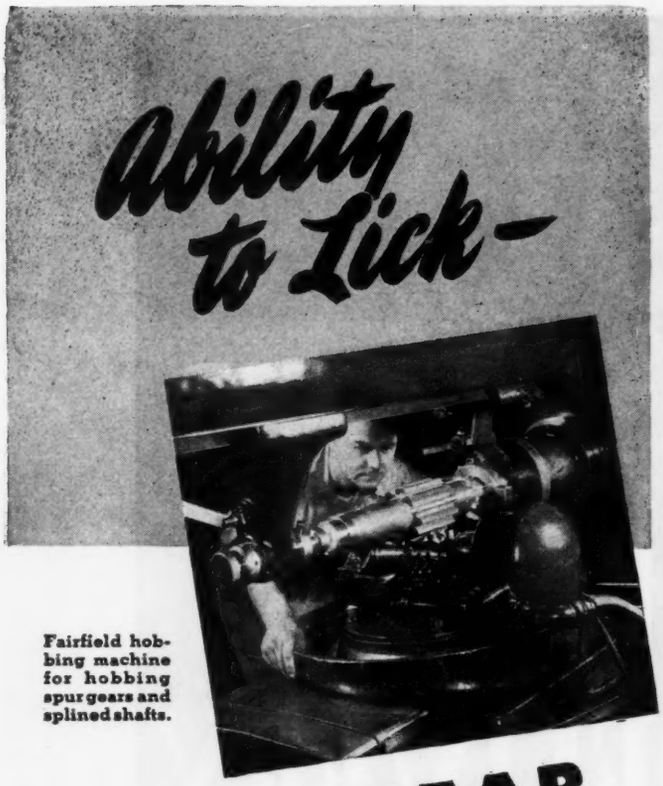
RICHMOND HILL, N. Y.

TEL. VIRGINIA 7-5238



Fairfield hobbing machine for hobbing spur gears and splined shafts.

TOUGH GEAR *Production Problems*

FAIRFIELD'S production of many thousands of differentials for heavy duty trucks typifies an ability to produce all kinds of gears, splined shafts and differentials.

There are two big reasons why FAIRFIELD can make gears to specifications in such quantity. First, all departments are well-equipped with enough machines for almost any production run. Second, FAIRFIELD machinists are skilled craftsmen who know their trade . . . Next time you have a gear production problem, see FAIRFIELD first!

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309 S. Earl Avenue • Lafayette, Ind.

FAIRFIELD For FINE GEARS

A BACKGROUND OF KNOWLEDGE AND EXPERIENCE

Johnny Gear has the know how for gear production—experience gained in a lifetime of service to industries, in war and peace. Talk to Diefendorf Gear experts for complete co-operation on gears for production or maintenance — in all materials.

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SYRACUSE 1, NEW YORK

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Excellent facilities to fulfill specifications for heat-treated alloy steel Gears . . . Special Gears . . . Special Gear Units . . . Roller-Chain Drives . . . Fabroil and Bakelite Pinions.

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GEARS — ALL MAKES . . . Special and Standard
PRECISION GEARS UP TO 200 DIAMETRAL PITCH
All Gears certified for Accuracy Quality and Fine Workmanship
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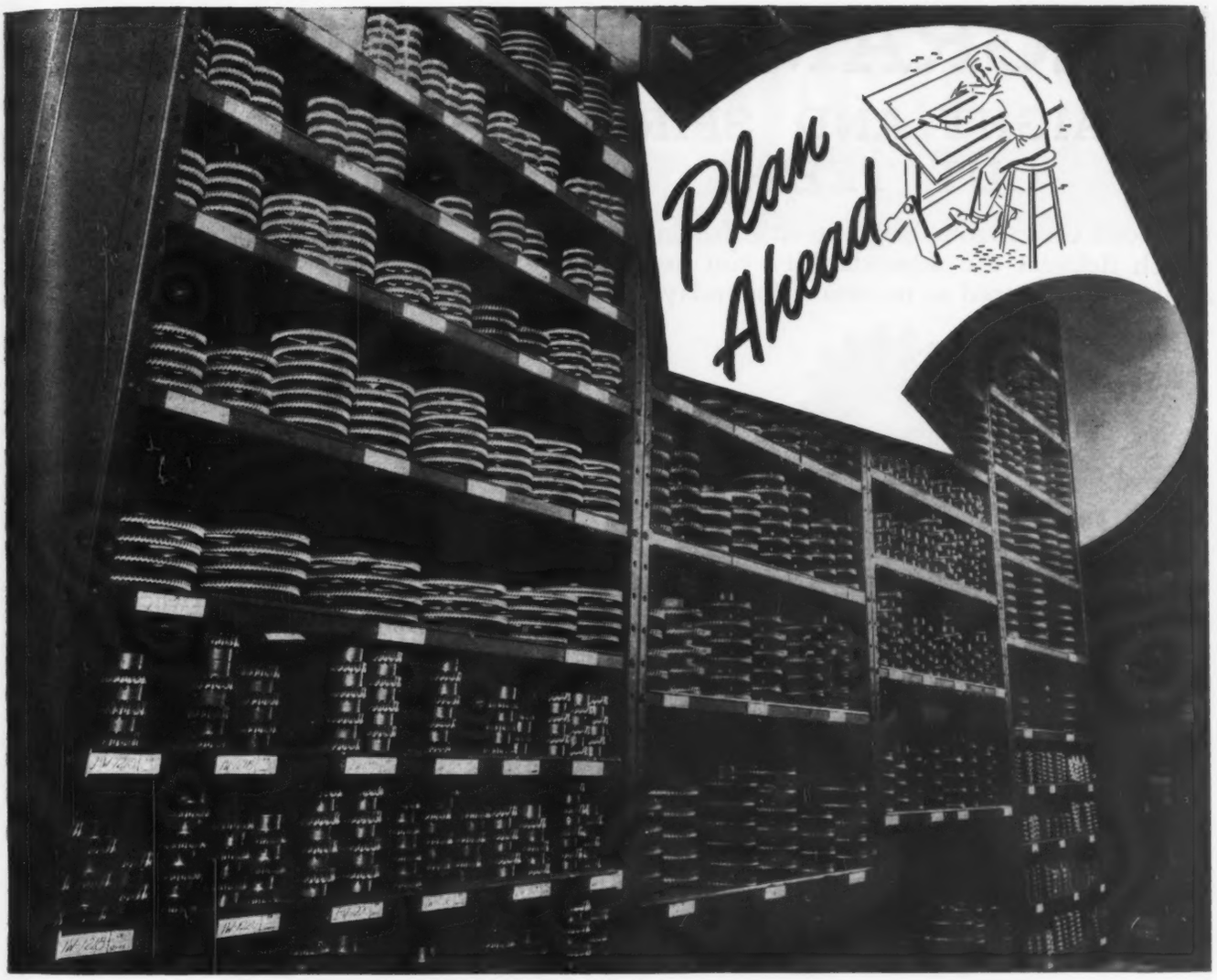
SEND US YOUR PRINTS FOR *Quotations*
GEAR SPECIALISTS—BROACHING THREAD GRINDING
TAYLOR MACHINE Co.
1917 EAST 61ST ST. • CLEVELAND 3, Ohio



with OHIO STOCK GEARS

The other day we received an order from one of our customers specifing immediate delivery on certain gears. Checking back we found the unit also required motors so we inquired, "When can you get delivery on the motors?" "Oh", replied the customer, "we ordered the motors eight months ago!"

The Ohio Stock Gear situation has improved, substantially, but quantities are limited and deliveries of certain types are not nearly as early as we'd like them to be.

So, just as a suggestion, it might be advisable to plan, *and place*, gear needs at the earliest point possible in your production plans. It's one way of making sure you have the gears when you need them.

THE OHIO GEAR COMPANY
1331 EAST 179th STREET • CLEVELAND 10, OHIO

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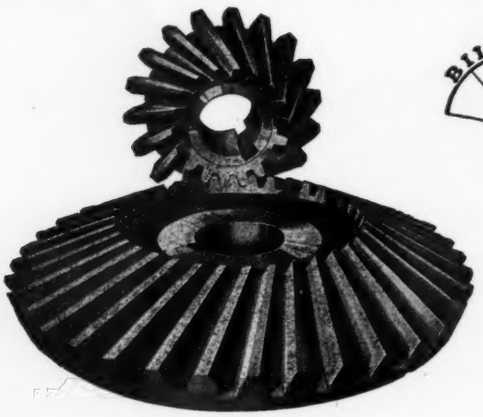
Stocks carried.

OHIO GEARS

BILGRAM BEVEL GEARS

STRAIGHT AND SPIRAL CUT TEETH

Get your Gears from Bilgram—it's the one place which delivers the dependability you need, the accuracy and speed so necessary for today's pace!



All Types—All Materials

Ellipticals, Herringbones, Helicals, Racks, Spurs, Hypoids, Worms, all types of gears made by specialists with modern gear manufacturing equipment.

BILGRAM GEAR & MACHINE WORKS

Manufacturers of Bevel Gear Generators and Chamfering Machines

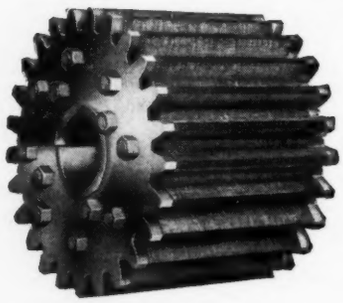
1217-1235 Spring Garden Street — Philadelphia 23, Pa.

Longest of an

ECONOMICAL • SMOOTH • EFFICIENT

Life!

WHEN IT'S A STAHL GEAR



Silent!

Rawhide spur pinion mounted on cast iron center. Pinion 21.600" O.D., 17" face overall, 15" face of rawhide, 1" brass flanges each side, 25 teeth 1¼ D.P., 5¾" bore. Stahl is geared to serve you well.

THE STAHL GEAR AND MACHINE CO.

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SPURS, SPIRALS, BEVELS, RACKS, WORMS • ANY SIZE • ANY QUANTITY

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GEARS

QUALITY GEARS AT THE SIGN OF MP

Gear-making is a specialist's job . . . here at the Meisel Plant you are assured of first quality in design, construction, hardening and finishing . . . the result manifests itself in smoother, quieter operation, with less "down" time.

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ALL TYPES OF GEARS
Any Material
Any Quantity
Any Size

OVER A QUARTER CENTURY MAKING GEARS

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LUCAS "PRECISION"

Horizontal Boring, Drilling and Milling Machine

THE LUCAS MACHINE TOOL CO.
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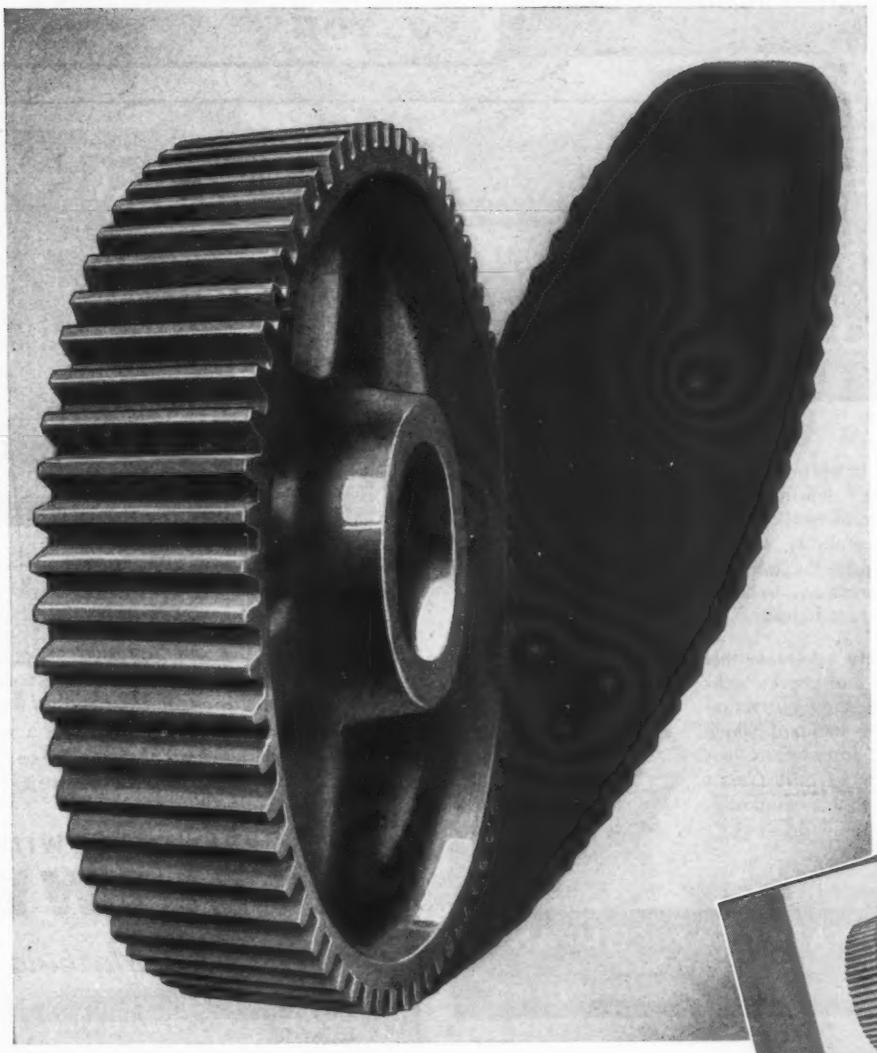
NOW AND ALWAYS OF

GEAR HEADQUARTERS

for over 54 years



For over 54 years we've been known as *"Gear Headquarters,"* for one or thousands of gears of any Type, Size or Material. The famous *"Gear Book,"* will be gladly sent upon request on your business letterhead.

Philadelphia
GEAR WORKS INCORPORATED
ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
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Industrial Gears and Speed Reducers
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GRANT GEARS

— have since 1877 been the main source of supply for the gear needs of many leading plants throughout the country. Grant workmanship and service are factors well worth your consideration when you specify gears.

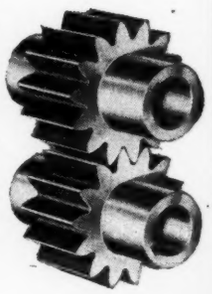
GRANT GEAR WORKS
BOSTON MASS.

PREFERRED BY MOST!

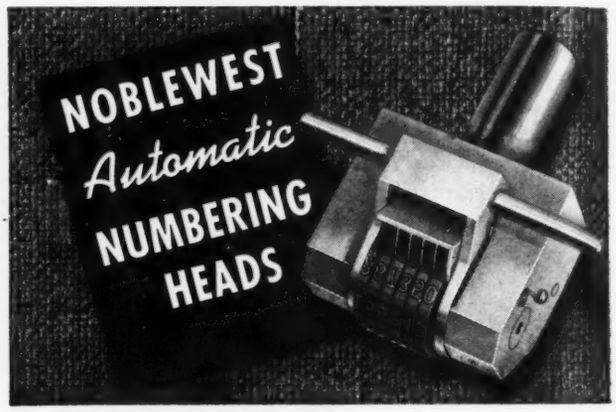
- ★ SPUR
- ★ BEVEL
- ★ HELICAL
- ★ SPLINE
- ★ WORM
- ★ SPECIAL

Faster assembly, better production, longer unit life demand gears with uniformity plus quality. The traditional dependability of Cincinnati Gears under the toughest of operating conditions is being emphasized as never before.

Bettered by every advantage that modern science and proven techniques can give, they are representative of that standard which for more than forty years has made *"Gears . . . Good Gears Only"*, the first choice of industry.



THE CINCINNATI GEAR COMPANY
"Gears . . . Good Gears Only"
Wooster Pike and Mariemont Ave. ★ Cincinnati 27, Ohio



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Noblewest Automatic Numbering Heads are precision made. They can be relied upon to number consecutively with automatic operation under the most exacting conditions. Furnished in a wide variety of models and sizes. Also in combination with marking dies to meet any requirement for round or flat surfaces. Write Noble & Westbrook Manufacturing Co., East Hartford 8, Conn.

MARK IT BEST WITH

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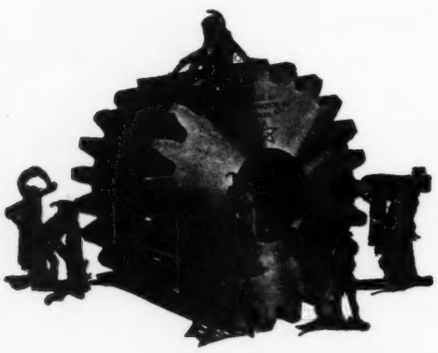

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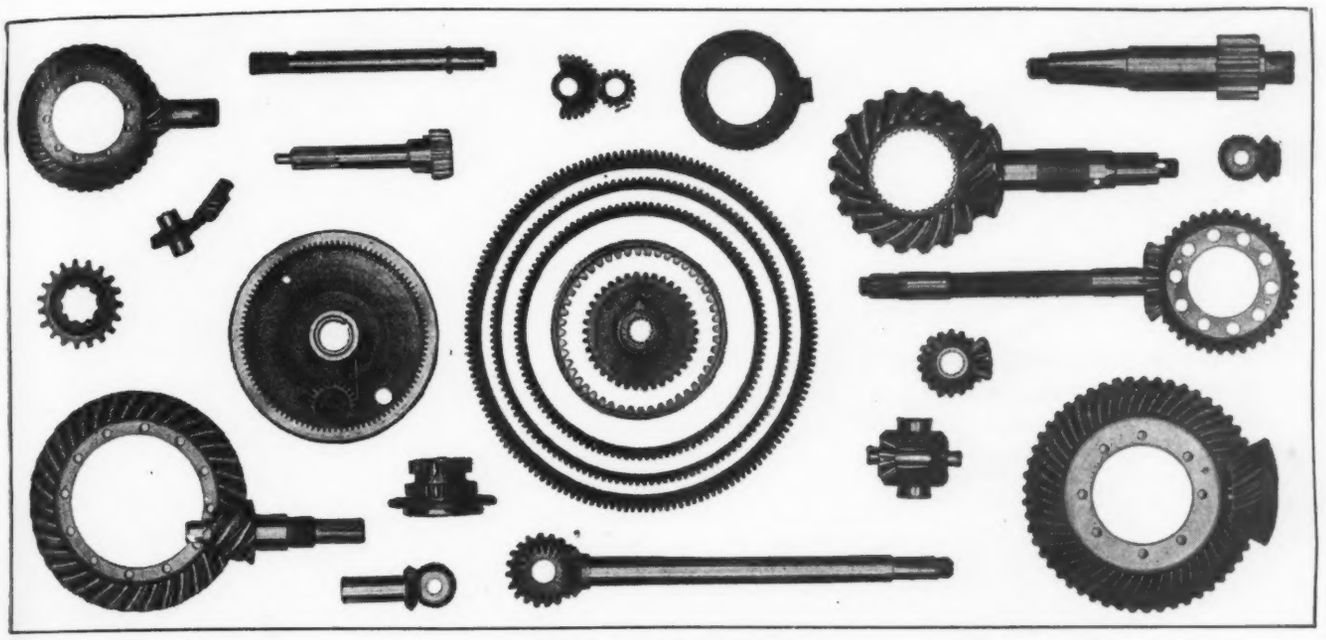

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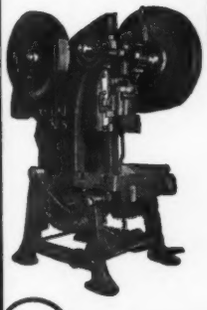

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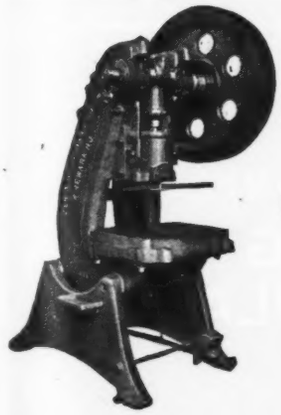

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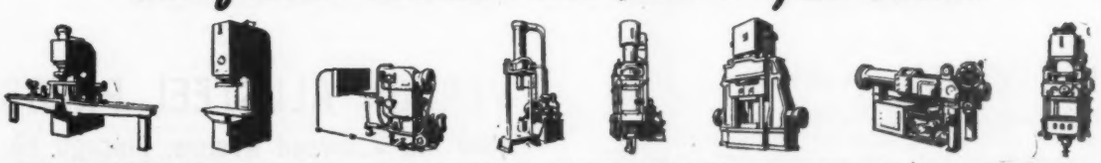

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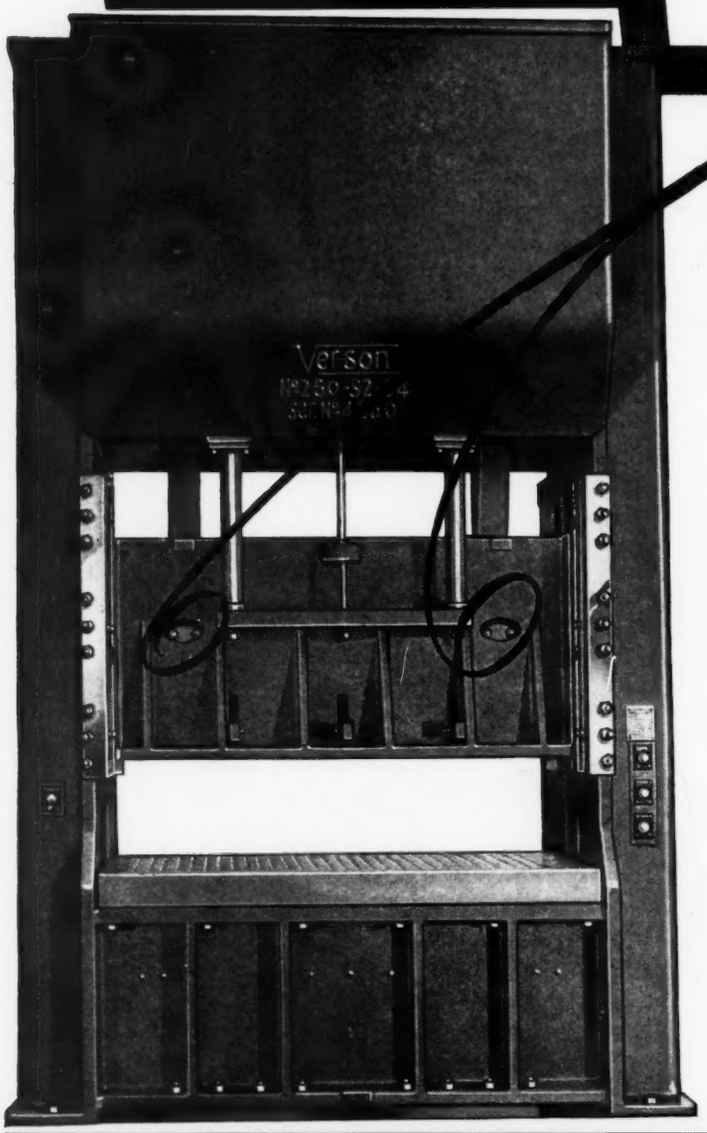

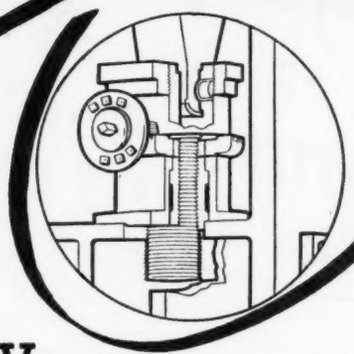

Barrel-Type Adjusting Screw

VERSON designs and builds by the old standard that a complete press is *no better than its component parts.* That's why in Verson Presses you will find many unusual features—important advantages that add up to better press performance.

Verson Barrel-type Adjusting Screws, for example, are extra long and well guided with heavy buttress threads assuring maximum safety. They remain vertical in all positions of the stroke, eliminating bending moment.

Making adjustments simple, sure and safe, conforms with the Verson principle of engineering better component parts to achieve more efficient presses.

Verson originated all steel welded press construction and has an accumulated 25 years of successful press engineering. That experience can be profitably applied to *your* metal working problems.

other Verson advantages

1. Extra long, bronze lined gibs, which increase accuracy and die life; 2. Verson Pneumatic Clutch and Brake Unit, which eliminates clutch and brake overlap; 3. Automatic press control; 4. Automatic lubrication; 5. Air Counterbalance to slide, increases safety and insures smoother operation; 6. Verson die cushions in the bed; 7. Automatic Feeds.

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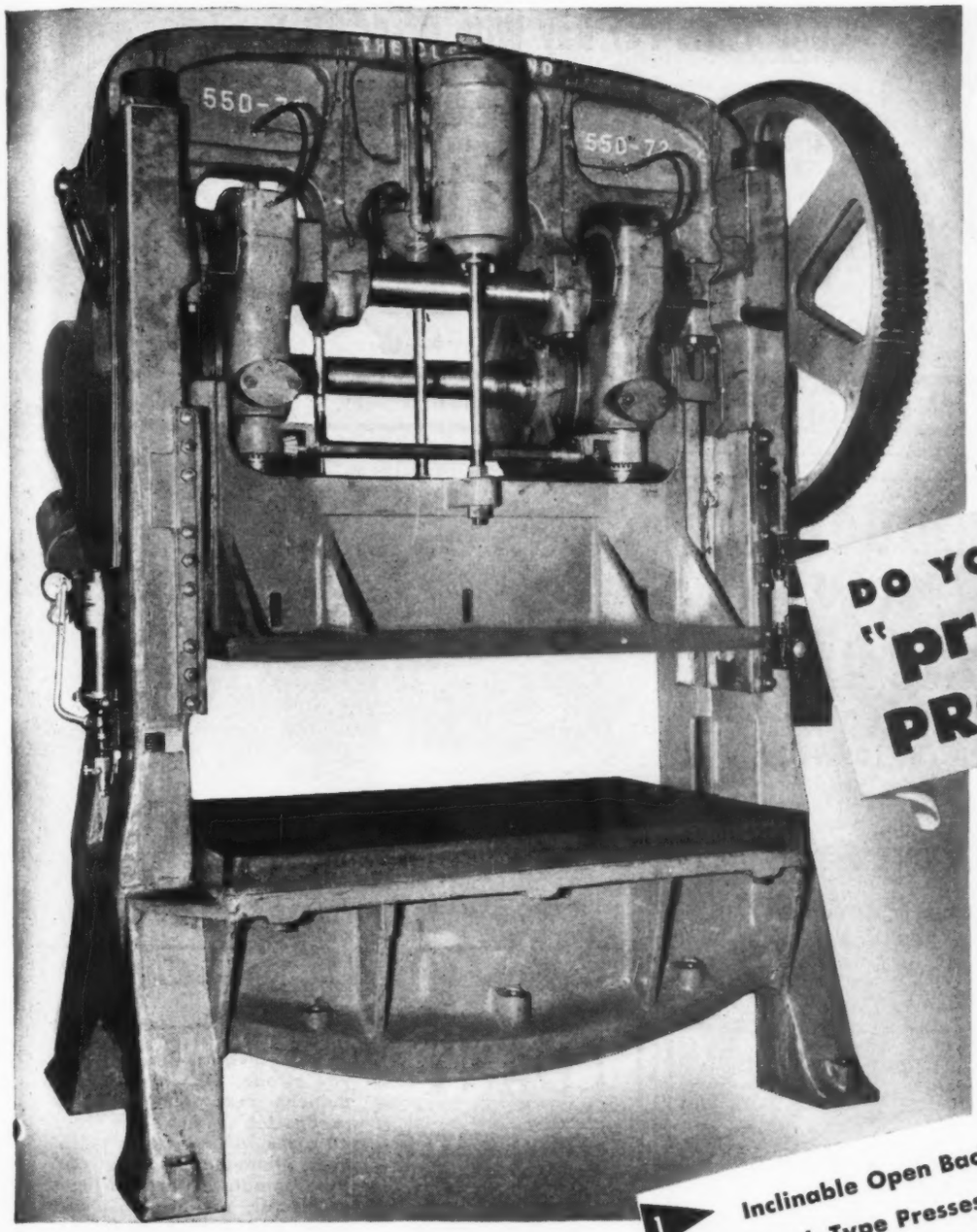

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Cleveland Straight Sided Double Crank Presses are built in a wide range of sizes and capacities and the fact that they can be furnished with stroke, die space, bed area and distance between uprights to suit particular requirements, makes them available in an almost unlimited number of combinations.

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The Press illustrated above has a 4" stroke, 3" adjustment, 48" x 72" bed area, operates at 35 RPM, has a capacity of 110 tons and is equipped with an electrically controlled air operated friction clutch and brake.

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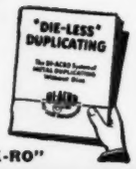

4,000 Parts Per Day With DI-ACRO Bender

Here is an example of "DIE-LESS DUPLICATING" typical of a great variety of formed parts readily made with DI-ACRO Precision Machines,—Benders, Brakes, Shears. Picture shows the finished part formed to die precision, including acute right angle bend. Women operating DI-ACRO units maintain a high out-put on production work.

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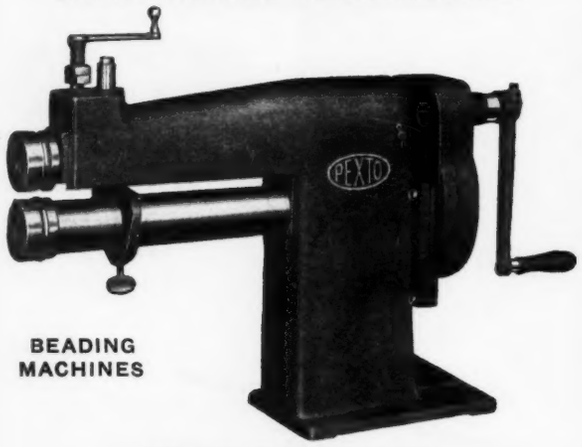

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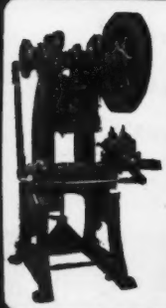

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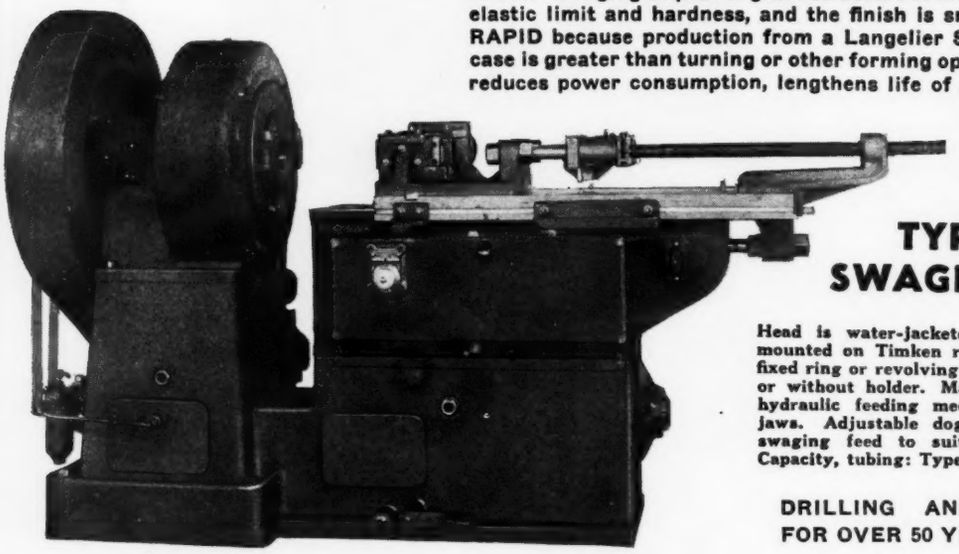

TYPE D and E SWAGING MACHINE

Head is water-jacketed for hot or cold swaging. Spindle mounted on Timken roller bearings. Head construction with fixed ring or revolving cage is optional. Can be furnished with or without holder. Machine as shown here is equipped with hydraulic feeding mechanism and hydraulic work clamping jaws. Adjustable dogs vary length of quick advance and swaging feed to suit requirements. Return is automatic. Capacity, tubing: Type D, 1⅛". Type E, 1½".

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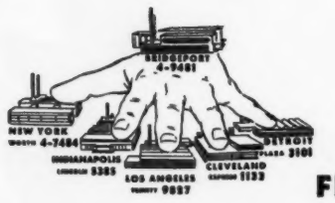

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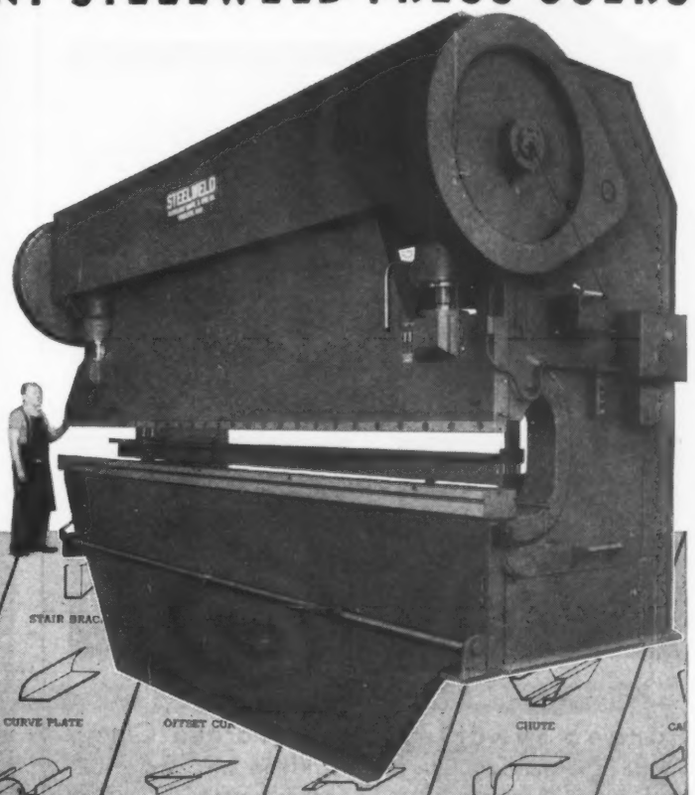

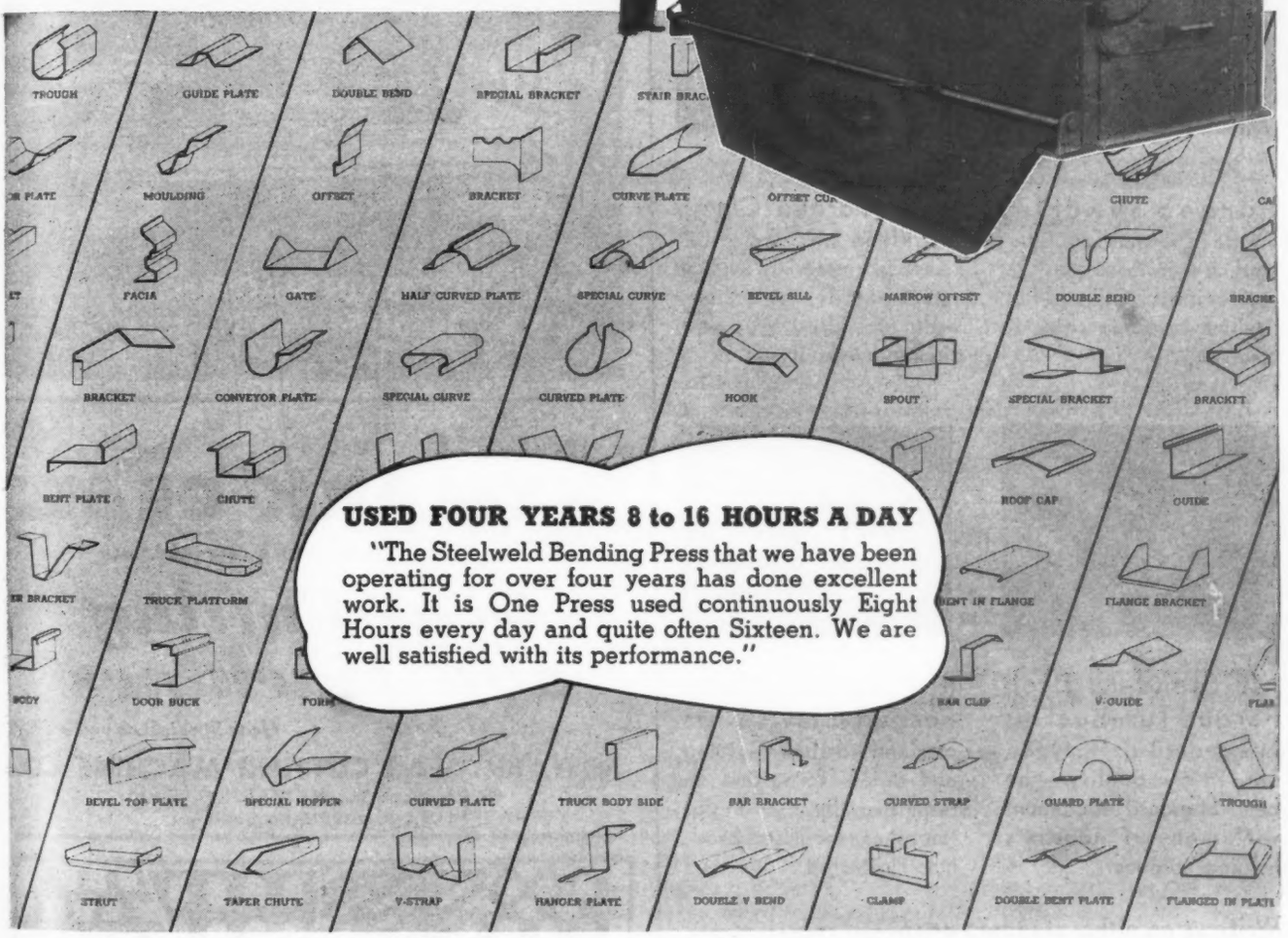

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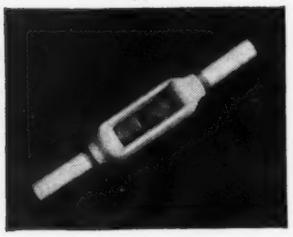

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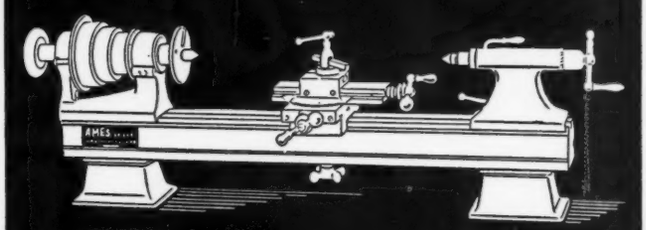

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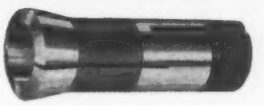
the Wade No. 8A toolmakers' lathe . . .

has such features as . . .



1. A spindle supported by an SKF double row cylindrical roller bearing plus two heavy duty precision roller bearings, all preloaded.
2. Especially designed collets, tools, and attachments to insure enduring accuracy and long life.
3. Rugged, exact construction throughout every part and every assembly.

which result in . . .

1. A spindle of greater rigidity permitting heavier cuts, smoother finishes, greater accuracy, and increased production.
2. Longer precision ground collet bearing surfaces that assure true running throughout a long life—a greater range of regular turning operations plus grinding and the turning of odd shapes.
3. An ability to turn out tools and parts with a degree of precision not usually possible in larger, or smaller, machine tools.

These advantages, plus twelve spindle speeds from 35–2000 R.P.M., lead screw accuracy of ± .0005 per foot of lead, a unique, quick-operated, belt-shifting mechanism—and extremely sensitive control all add up to make the Wade No. 8A Toolmakers' Precision lathe a highly productive, extremely accurate machine tool with an exceptional stamina that means extra years of profitable operation.

Wade

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THE WADE TOOL CO.
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Please send me without obligation your Catalog giving complete details on the Wade No. 8A Toolmakers' Lathe.

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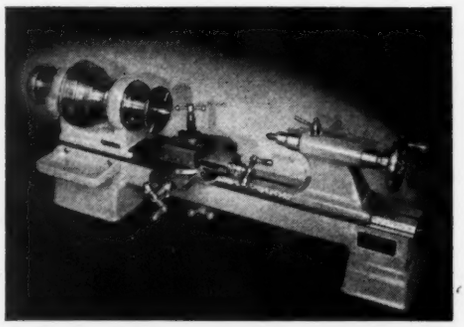
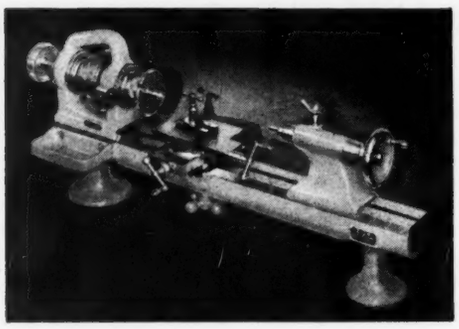
STEP UP PRODUCTION ON SMALL DIAMETER WORK *with* . . .



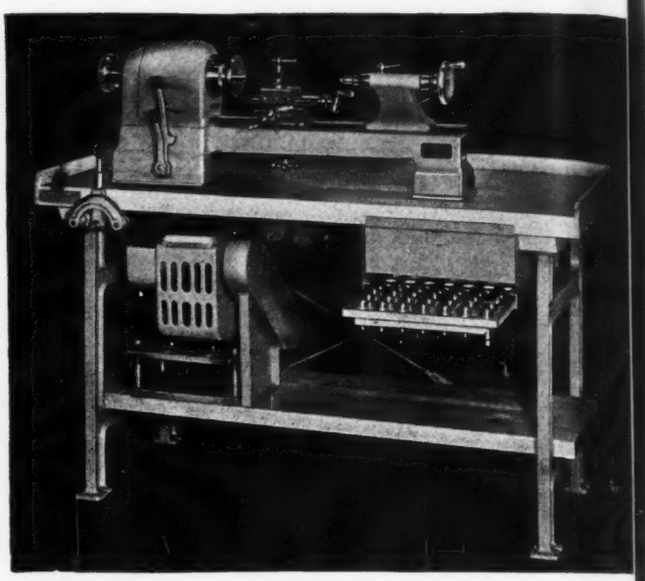
MODEL CB-5C PRECISION BENCH LATHE

Open Cone Headstock. 1" collet capacity, 9" swing, 17" between centers, 36" bed. Speeds up to 4000 RPM. Flat belt only.



MODEL 4EV PRECISION BENCH LATHE

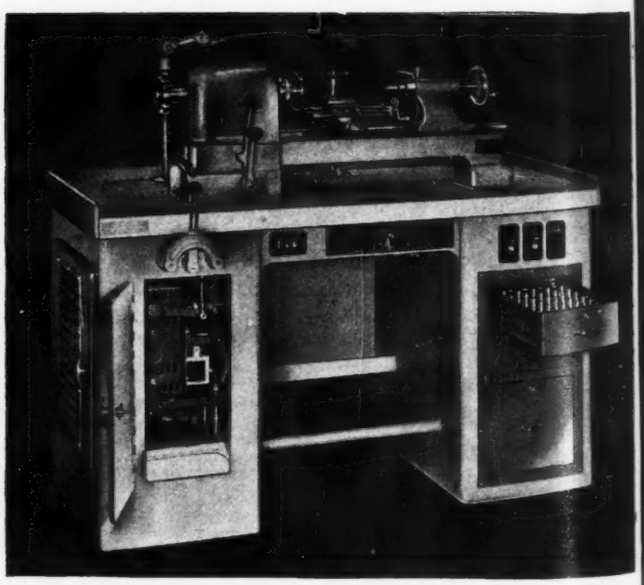
Open Cone V-belt Headstock. For either V or flat belt operation. 7/16" collet capacity, 7" swing, 17" between centers, 32" bed. Speeds up to 10,000 RPM.



Elgin Open Bench Lathe

Laminated hard maple top, enclosed motor, safety guard for belt, handy collet drawer. Variable Speed Drive for any spindle speed from 120 to 3800 RPM. 9" swing, 17" between centers, 1" collet.

THE entire line of ELGIN High Speed Precision Bench Tools is designed to pay you dividends in better machining results, faster production, greater versatility, maximum operator convenience. The machines shown here assure "complete coverage" of your needs for both toolroom and production work. Note the trim, clean-cut lines . . . the provisions for operator comfort . . . the ample storage space for tools and accessories. And remember—the Elgin Bench Tools shown in the large illustrations (with exception of Vertical Miller) are equipped with the VARIABLE SPEED DRIVE which permits instant changes of spindle speeds over a wide range of RPM without stopping spindle and shifting belt. Operator is encouraged to use proper speed for each operation, changing as often as necessary . . . which means closer precision, better finishes. Write for specifications, prices, delivery dates!



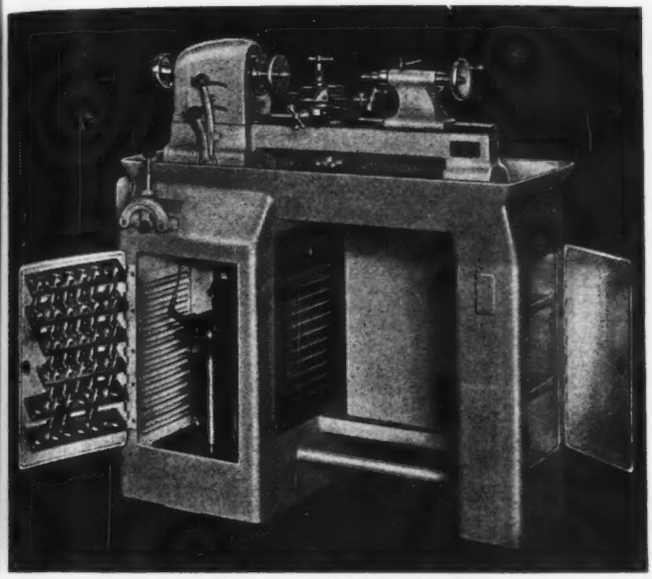
Elgin Desk Type Bench Lathe

Variable Speed Drive, 40 to 4000 RPM. Low speed rate for grinding operations. Free turning spindle for truing-up and setting work by hand. Ample drawer space. 9" swing, 17" between centers, 1" collet.

ELGIN TOOL WORKS

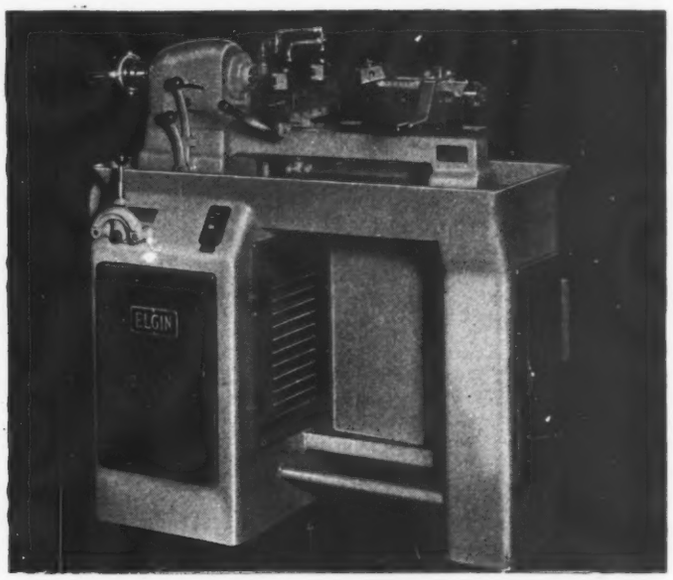
1770 BERTEAU AVENUE, CHICAGO 13, ILL.

ELGIN BENCH TOOLS



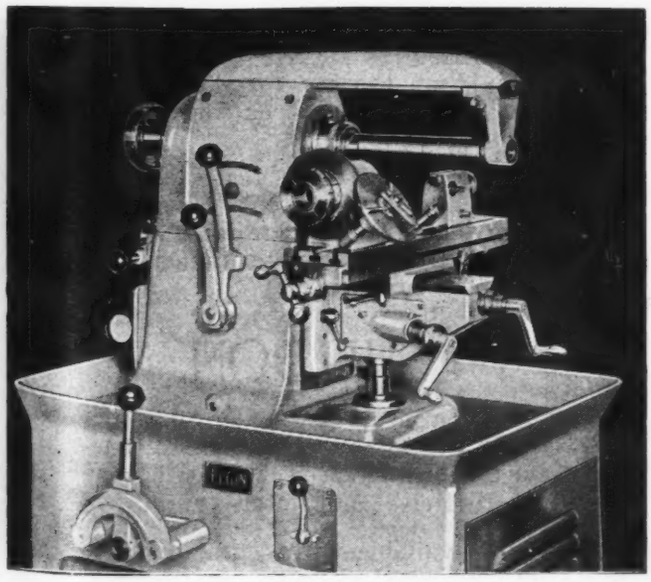
Elgin Knee Hole Type Bench Lathe

Has Variable Speed Drive with range from 120 to 3800 RPM. 9" swing, 17" between centers, 1" collet. Generous leg room for operator. Door of motor cabinet fitted with collet rack. Three roomy storage shelves.



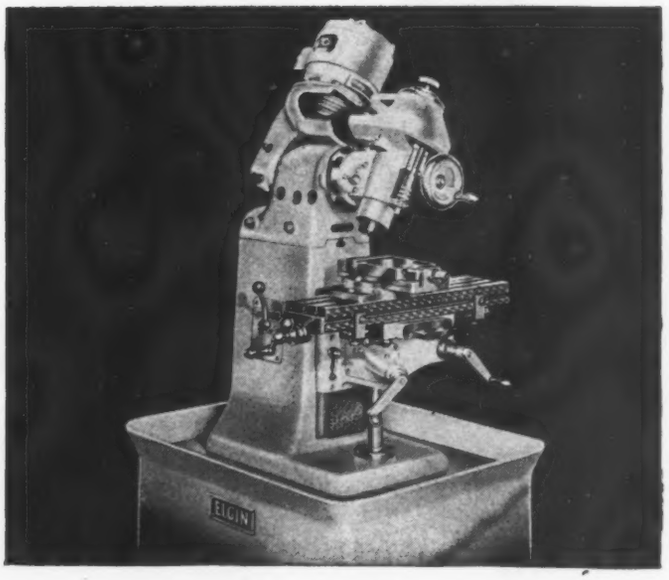
Elgin Knee Hole Type Hand Screw Machine

Variable Speed range, 120 to 3800 RPM. 9" swing, 1" collet capacity. Collet rack inside of motor compartment door. Independent coolant system (5 gal.) mounted in rear, outside—cleaner, more accessible.



Elgin Horizontal Bench Milling Machine

Equipped with Variable Speed Drive for spindle speeds from 85 to 2750 RPM. Collet capacity, 1". Table 4⅛" x 18". Longitudinal travel, 12". Transverse travel, 6". Vertical travel, 6".



Elgin Vertical Bench Milling Machine

Preloaded ball bearing spindle. 9/16" collet capacity. Five speeds ranging from 400 to 4000 RPM. Vertical travel of spindle, 1¾". Table 4⅛" x 18". 90° swivel each side of center line.

MOREY *Universal* TURRET LATHES
for BAR or CHUCKING

THE TURRET LATHE *Your Operator* APPROVES!

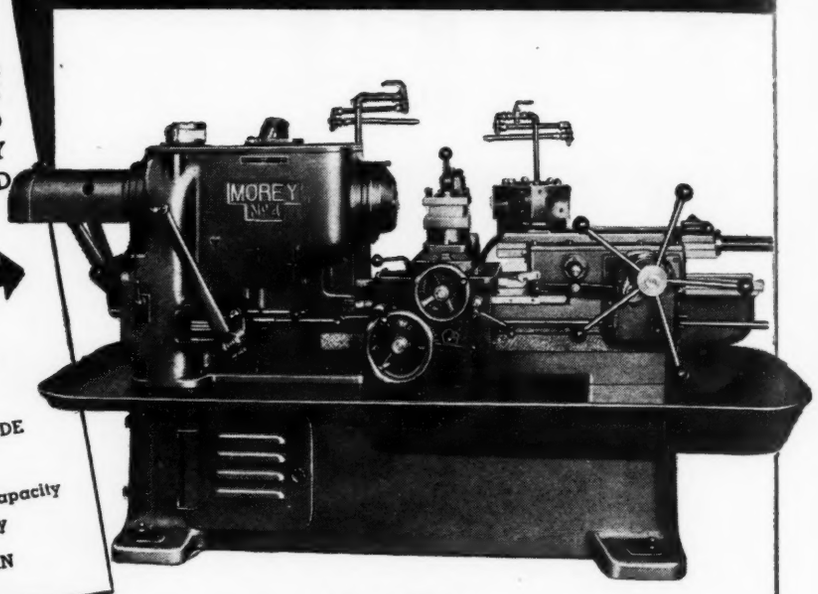
EASY TO OPERATE • ACCURATE
DEPENDABLE • RIGID AND
POWERFUL ENOUGH TO FULLY
UTILIZE PRESENT-DAY HIGHSPEED
CARBIDE TOOLS

#4 UNIVERSAL

For bar stock up to 2" in diameter
12" turning length 19½" swing over bed
Infinite spindle speeds: 35 to 1500 RPM.
constant speed motor, 1200 RPM
MAY BE HAD WITH PLAIN CROSS SLIDE

Also available in
No. 3 Universal, 1½" capacity
No. 2 Plain, 1" capacity

ASK FOR DESCRIPTIVE BULLETIN



STOCK DELIVERY

DESIGNED AND BUILT BY
MOREY MACHINERY CO., INC 410 BROOME STREET, NEW YORK 13, N. Y.
PLANT: 4-57 26TH AVE., ASTORIA 2, NEW YORK

Have you seen the new SHELDON Lathes —

. . . . those built in the new SHELDON machine tool plant? Always good lathes, these new SHELDONS are even better, not only in design refinements but in extreme accuracy, greater work capacity for size, "sweeter" handling and actual beauty of finish. Only a set-up like the new SHELDON plant could build such lathes—a specially designed building, the most modern manufacturing methods, complete tooling with row on row of the finest, most modern manufacturing equipment.

Make it a point to stop in at your SHELDON dealer and see these new machine tools. Note their moderate prices. They are a revelation of what modern equipment and methods produce.

SHELDON

S-56 Lathe 11¼" swing, 1" collet capacity, 35" between centers. Complete with 4-speed V-Belt Underneath Drive and Motor.

Also available with center distance of 24" and 48" (48" on pedestal base). ***Write for Catalog.***

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Manufacturers of Sheldon Precision Lathes • Arbor Presses • Vises
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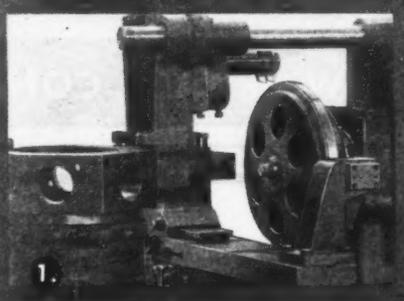
ACME Turret Lathe

unexcelled for Low Cost machining of

Gate Valve Parts



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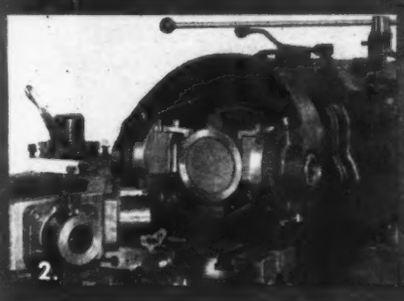

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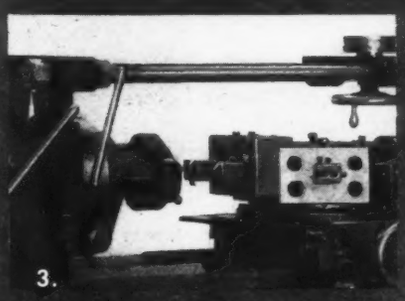


3.

The Cincinnati ACME TURRET LATHE is designed for the complete job.

Complete machining of VALVE STEMS.
Rolling in of VALVE SEAT RINGS.
Machining of VALVE BODIES.
Machining of WEDGES.

1. No. 15-25" FIXED CENTER UNIVERSAL TURRET LATHE—Special tooling for rapid production of VALVE SEAT RINGS. An air controlled holding fixture eliminates possibility of distorted ring when clamping. Adjustable overhead turning heads provide quick means for setting cutters with minimum overhang on various diameter rings.

2. Three position indexing fixture for facing sides—drilling and tapping solid GATE VALVE WEDGES.

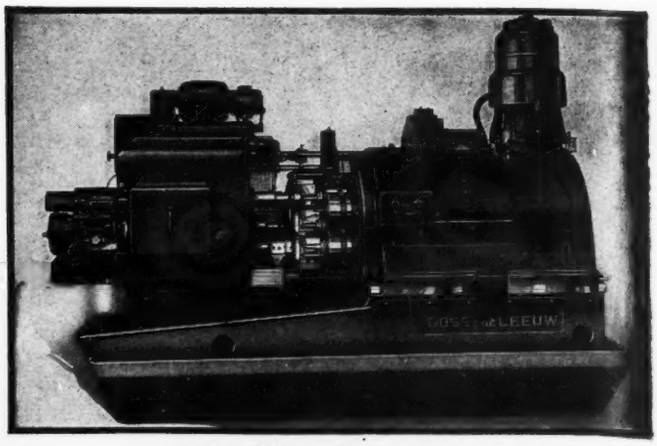
3. Arrangement for rolling in VALVE SEAT RINGS.

Send your problems to our Engineering Dept.

The ACME MACHINE TOOL Co.

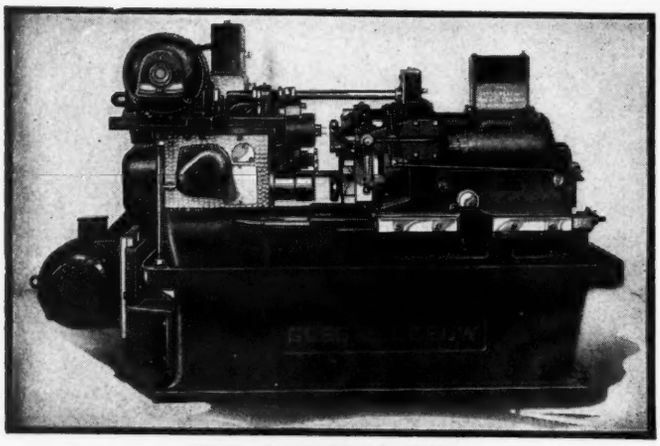
CINCINNATI 32, OHIO

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES



WORK ROTATING TYPE

5 Spindles • 6 Spindles • 8 Spindles



TOOL ROTATING TYPE

4 Spindles • 5 Chucking Positions

Both types of machines provide lead screw threading. Oversize spindles on these machines are mounted on pre-loaded anti-friction bearings. Ways are hardened; gears are of chrome-nickel steel, carefully heat-treated.

The many modern features offered in these machines are fully described in catalog available on request.

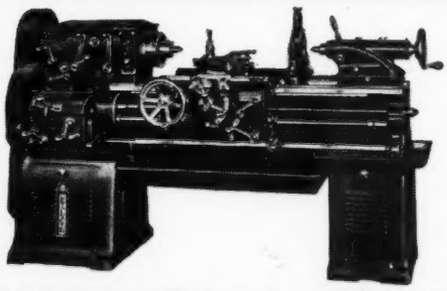
GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

POWER...

• High quality engineering design and manufacture enable Smith & Mills Crank Shapers to handle easily all types of jobs within the individual machine's range with precision and power to spare. A wide range of feeds and speeds, plus simplicity of operation, makes for efficient, low cost production, Shaper sizes 12" to 32" are fully described in S & M's latest catalog—yours for the asking.

THE SMITH & MILLS CO.

2887 Spring Grove Ave. Cincinnati 25, Ohio



BRADFORD *Metalmaster* LATHE

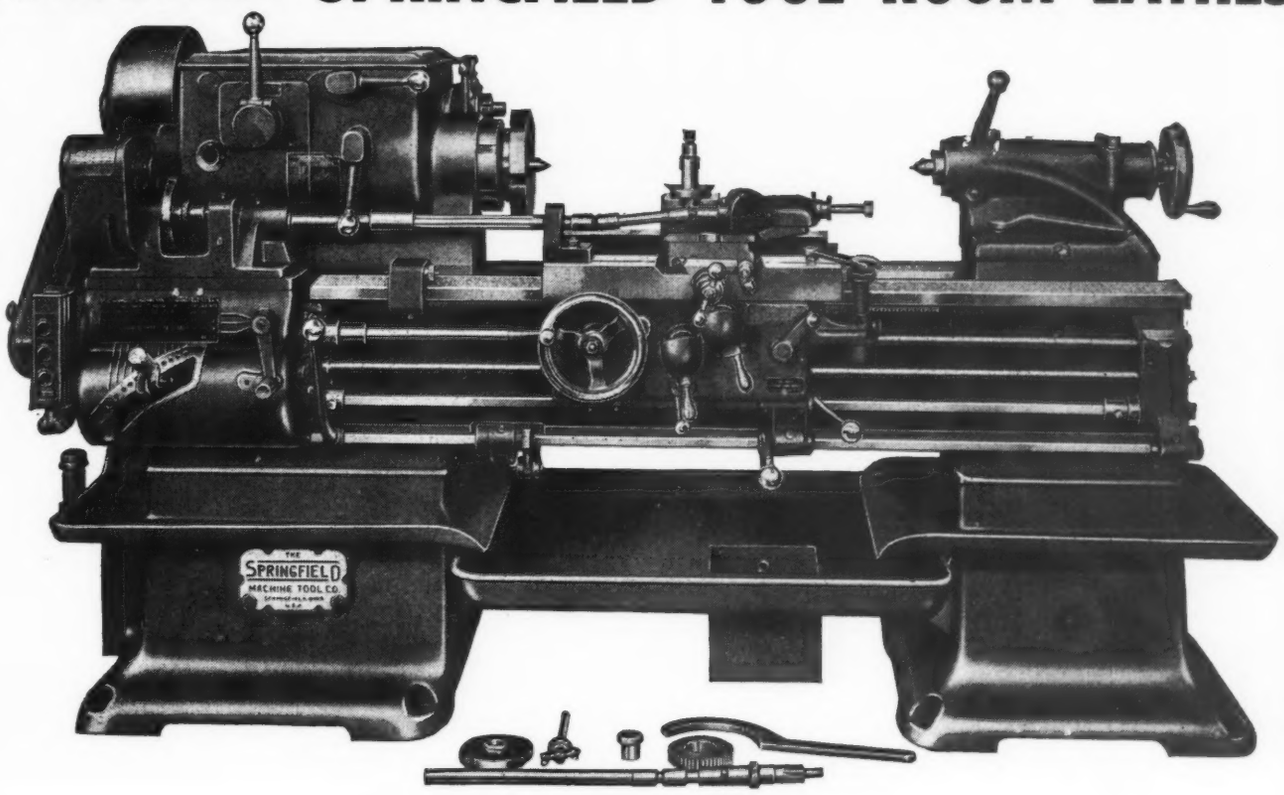
features...

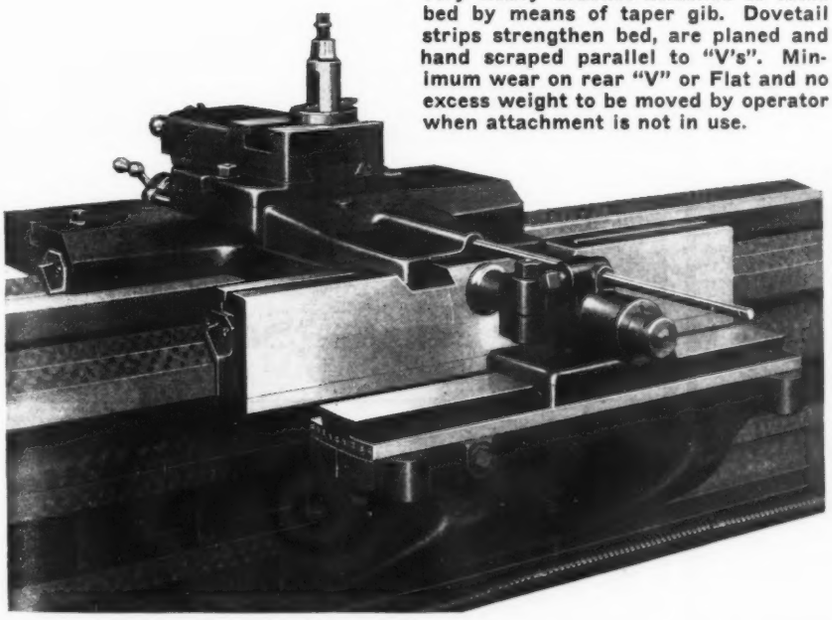
1. Oil Gages.
2. Push Button Station.
3. Three Speed-Change Levers.
4. Large Dials.
5. Offset Compound Rest.
6. Heavy Tailstock Clamp Bolts.
7. Ball Thrust Bearing.
8. Adjustable Feed Stop—Either Direction.
9. Starter in Leg.
10. Leveling Screws.
11. Sixty-four Feeds and Threads.

The BRADFORD MACHINE TOOL CO.

1840—1946 CINCINNATI, OHIO

Meet today's Competition WITH RUGGED, DEPENDABLE SPRINGFIELD TOOL ROOM LATHES



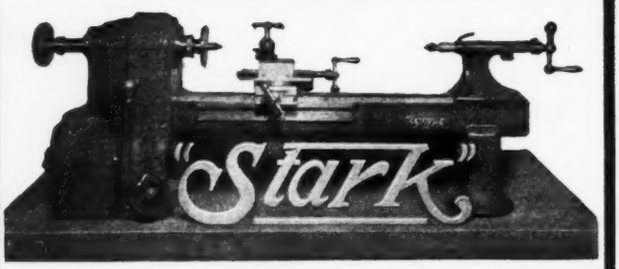


TAPER ATTACHMENT consists of very heavy bracket attached to lathe bed by means of taper gib. Dovetail strips strengthen bed, are planed and hand scraped parallel to "V's". Minimum wear on rear "V" or Flat and no excess weight to be moved by operator when attachment is not in use.

Cost-minded production men choose Springfield Lathes . . . for they know that only a lathe geared to modern engineering practices will "come through" with the speed and accuracy demanded by today's keen competition. Higher speeds, improved cutting tools, increased use of new and tougher alloys—you'll find Springfield Lathes readily adaptable to whatever new requirements arise. From headstock to tailstock, every feature of Springfield design and construction contributes to that adaptability. Precision and operator convenience are typified in the Taper Attachment (left), which assures perfect accuracy, eliminates lost motion, and requires simple adjustment of only two nuts for engagement or disengagement. Other interesting construction details, plus full specifications, in Booklet No. 162. Write for your copy.

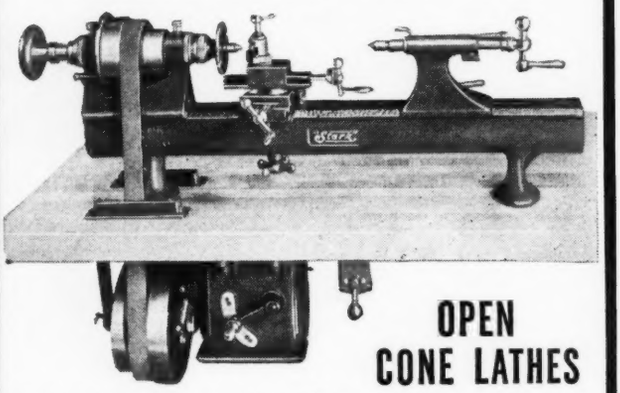
SEND TODAY FOR BULLETIN NO. 162

THE SPRINGFIELD MACHINE TOOL CO.
SPRINGFIELD, OHIO



Built-in infinitely adjustable drive with any speed at the turn of a convenient handwheel in front. No special bench or cabinet required. 156 to 2200 r.p.m. with Standard (toolroom) model and 220 to 3500 with High Speed (Manufacturing) model. Smooth brake and clutch. Capacity, 3/4" or 1" through headstock; 9" swing, 40" length bed.

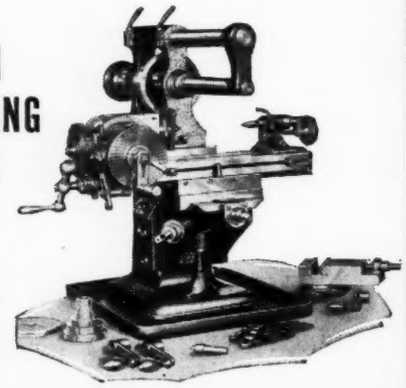
30 PRECISION ATTACHMENTS correctly designed for the very best facility and accuracy are interchangeable with all Starks of the same lathe size



OPEN CONE LATHES

Built in four good sizes, 1/4" x 5 7/8" swing, 1/2" x 7", 3/4" x 9" and 1" x 9" with Stark Motor Drive Unit, the first compact, smooth under-bench drive, with 9 speeds — the full working range.

PRECISION BENCH MILLING MACHINES



Plain and Spiral Models, motor-driven. Table 18" x 4", feed 10", transverse 3 1/2", vertical over vise 4 3/4".

FOR EXACTING PRODUCTION it is fitted with fast lever feeds

Also "ELECTROBLAST" Muffle Furnaces

Gas fired. High speed steel temperatures in 20 minutes. Built in two small sizes.

FOR FURTHER INFORMATION, WRITE US.

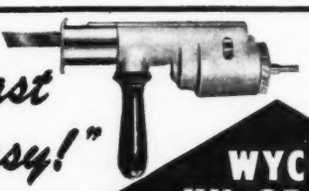
Stark Tool Company

WALTHAM · MASSACHUSETTS

ESTABLISHED · 1862

Originators of the American Bench Lathe

"It's Fast and Easy!"



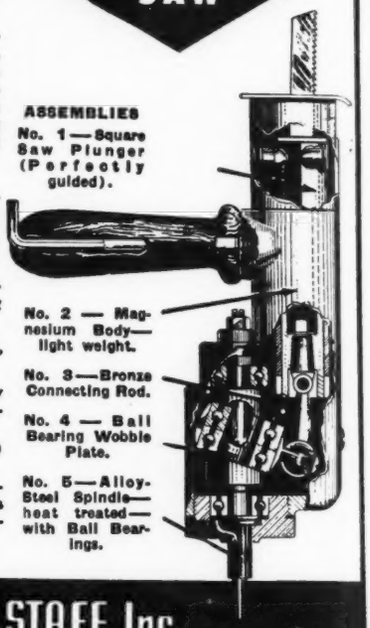
WYCO HY-SPEED SAW

Fits any 1/4" electric drill, air drill or flexible shaft.

Speedy! Accurate! Powerful! Saws and files metals, woods, plastics. Chucks in drill chuck or collet. Uses ordinary hack saw blades and standard 1/4" shank machine files. Easily used in difficult places.

- **All rotating parts ball-bearing, running in oil**
- **No gears. No cams. Always smooth-running.**
- **Square plunger with take-up for wear. All wearing parts heat treated.**
- **Saw chuck holds firmly, aligns saw perfectly.**
- **Complete with extra saw blade and 1/4" round machine file, $35.00. (Sold only thru jobbers)**

Send for Catalog on Complete Line of WYCO Tools and Flexible Shaft Equipment.



ASSEMBLIES

No. 1 — Square Saw Plunger (Perfectly guided).

No. 2 — Magnesium Body — light weight.

No. 3 — Bronze Connecting Rod.

No. 4 — Ball Bearing Wobble Plate.

No. 5 — Alloy-Steel Spindle — heat treated — with Ball Bearings.

WYZENBEEK & STAFF, Inc.

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SAWS for ALL METALS

Huther Bros. make the saw for your work—for brass, copper, aluminum, steel. Correct pitch, correct tooth form, correct steels—all contribute to maximum speed and efficiency. Write for our catalog of saws for every metal cutting need.

Huther Bros. Saw Mfg. Co.

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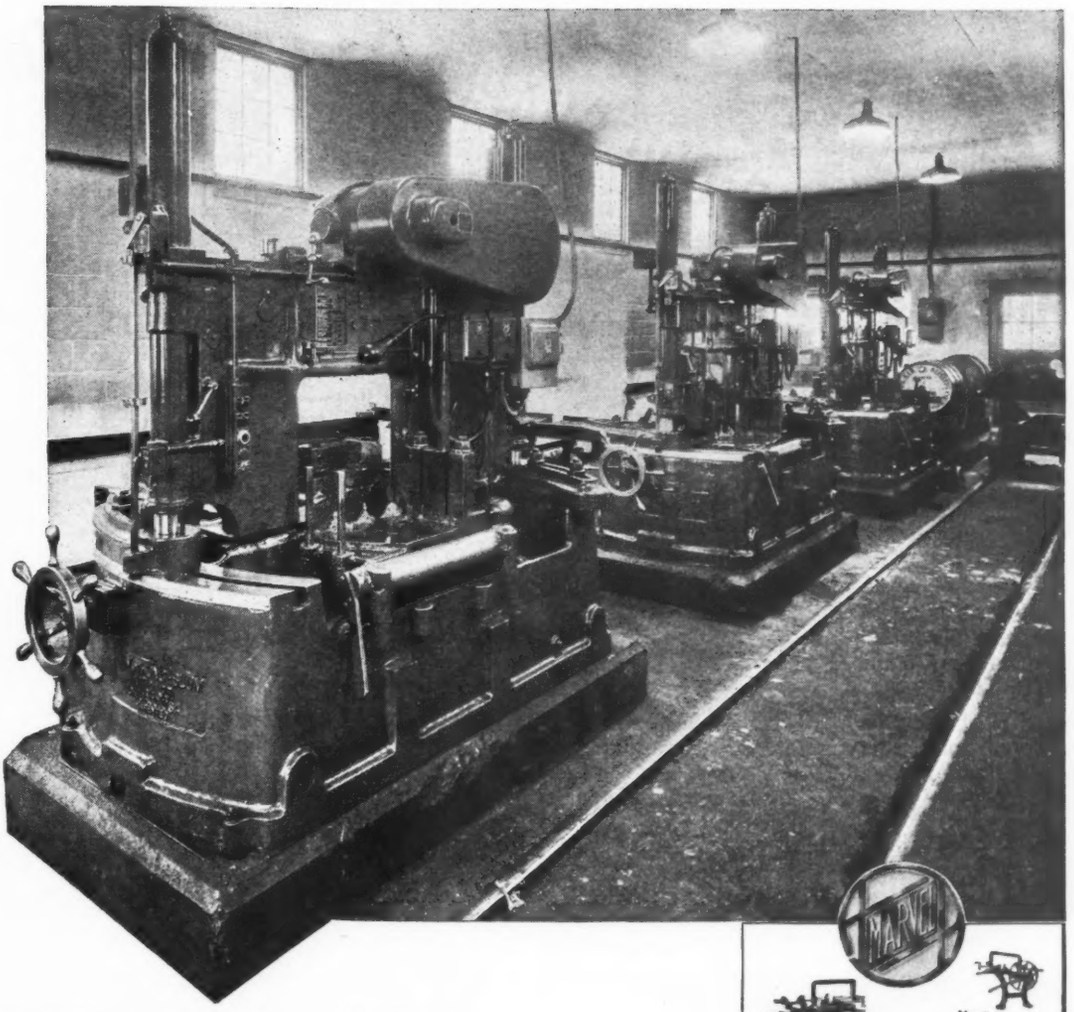


EASILY CUT-OFF TOUGHEST STEELS

Steels just don't come too tough for MARVEL Giant Hydraulic Hack Saws. Take, for example, the three No. 18 MARVEL Saws, at the Babcock & Wilcox steel mill, shown above. These machines are used to cut test specimens from sample pieces of stainless and other tough alloy billets which are checked for seams, pipes, etc., before being drawn into tubing. It takes tough steel to make the best tubing, and it takes modern sawing equipment to cut it rapidly, accurately and economically.

With 10 types of metal-cutting saws, each available in a series of variations, MARVEL can furnish sawing machines that exactly meet your requirements. If you have a metal-sawing problem—call in the local MARVEL Sawing Engineer.

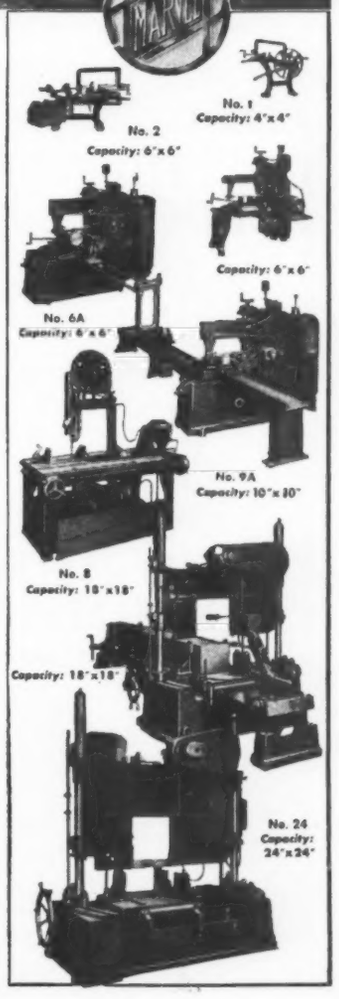
Write for MARVEL Catalog or check it in your Sweet's Catalog Files.

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

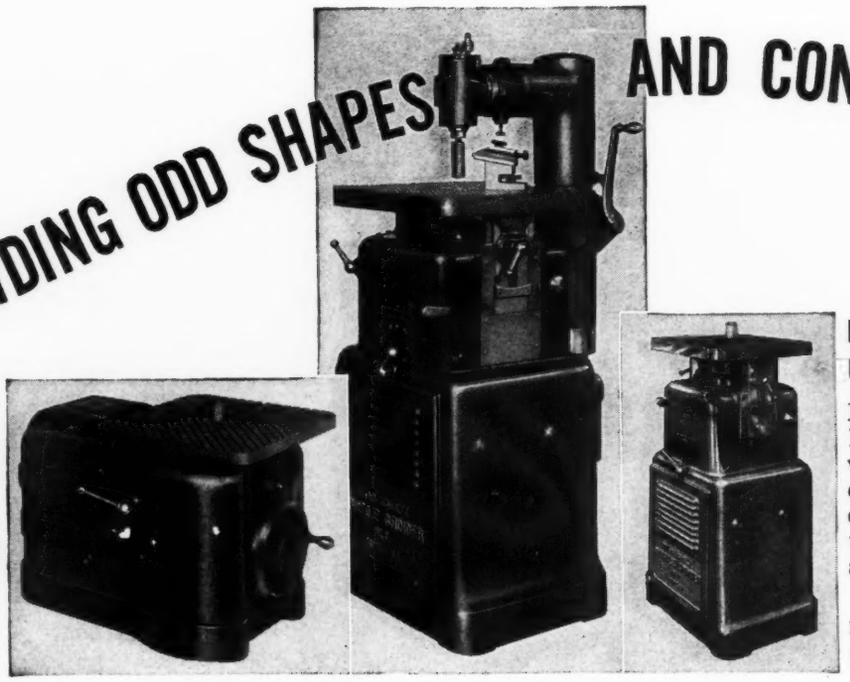
5700 BLOOMINGDALE AVENUE **CHICAGO 39, U.S.A.**

Eastern Sales Office: 225 LAFAYETTE ST., NEW YORK 12, N. Y.



MARVEL SAWS

FOR GRINDING ODD SHAPES AND CONTOURS



No. 1
PROFILE GRINDER

A bench size tool operating at 20,000 R.P.M. with vertical oscillations. For grinding die clearances, sharpening punches and economically finishing cams and templates.

In production grinding too, this Grinder has proved a valuable tool.

Boyar-Schultz Grinders are designed and built for grinding and finishing irregularly curved surfaces and contours so frequently encountered in the tool room and die shop. Dies and punches, templates, cams and special parts are finished with time-saving speed.

No. 2
PROFILE GRINDER

Dual Spindle Model. Larger floor model with two independently powered spindles, operating with vertical oscillations at 10,000 R.P.M.

A rapid stock remover even with small diameter wheels.

Single Spindle Model with lower spindle only. A tool that has demonstrated its value in the tool and die shop.

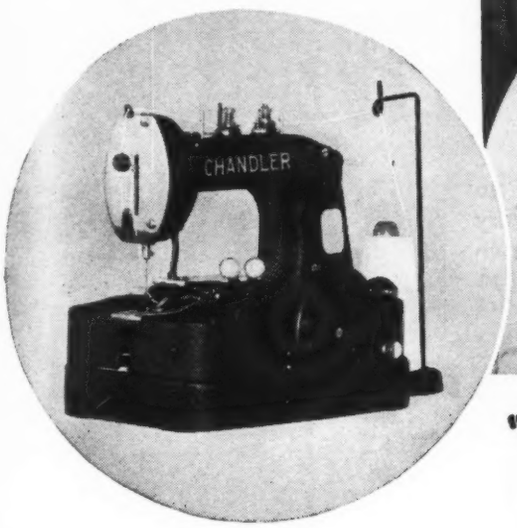
BOYAR-SCHULTZ CORPORATION

WALNUT STREET AT HOYNE **CHICAGO 12, ILLINOIS**

THEY STAY TRUER . . . LONGER
High quality grinding becomes high economy grinding with VITRIFIED WHEELS. They stay truer—longer. They will not gum or glaze. And they are not affected by heat, cold, oils, or acids.
Let our engineers study your grinding jobs and make recommendations for greater service and economy. No obligations, of course.
VITRIFIED WHEEL CO.
WESTFIELD, MASS.
VITRIFIED WHEEL COMPANY
WESTFIELD, MASS.

Right: Bench model Sunnen Precision Hone in use at Chandler Machine Company.

Below: The efficient, smooth operating Chandler Button-Sewer.



"WE GET SMOOTHER—TRUE HOLES FIVE TIMES AS FAST—

With the Sunnen Precision Honing Machine"

—CHANDLER MACHINE CO.

Hardened steel parts, bearings, connecting links, and other parts going into their sewing machines have been honed for several years at the Chandler Machine Company of Ayer, Mass.

Tolerance is held within .00025" with a very smooth mirror finish on the honed surface. Previous to using Sunnen honing, these parts were lapped — and copper laps were constantly wearing out, leaving bell-shaped holes. In addition to spoiling materials, lapping was costing them a great amount of unnecessary production time.

Now, the Sunnen Precision Honing Machine is giving them smoother finishes in more accurate holes — *at least* five times as fast.

If you have an internal finishing problem on which you need greater accuracy — or more speed — or a smoother finish, ask a Sunnen engineer to call, or write for a free bulletin giving complete details of Sunnen Honing.

The Sunnen Precision Honing Machine —

1. Hones and finishes internal cylindrical surfaces from .185" to 2.625".
2. Accuracy is guaranteed within .0001".
3. Produces super-smooth finish.
4. Used in ferrous or non-ferrous metals, plastics, ceramics, glass, etc.
5. Accurately duplicates sizes.
6. Does not require skilled labor.
7. Can be "set up" for any size in 1 minute.
8. No jigs or fixtures needed.
9. Economical to operate.

SUNNEN

SUNNEN PRODUCTS COMPANY

7940 Manchester Ave., St. Louis 17, Mo.

Canadian Factory: Chatham, Ontario

Typical Jobs

Cast Iron Valve Stem Guide. ½ to one thousandth removed — 220 pieces per hour. Better finish and straighter hole.

Carbureter Idler Valve Jet. Hole is honed after reaming for smooth action.

Stainless Steel Load Compensator Valve Seat. Hole is honed to .0002" limit.

Inner Bearing Ring "Accurately removes last 'tenth' of stock."

Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 inch."

PRECISION REID SURFACE GRINDERS

ASSURE PRECISION RESULTS

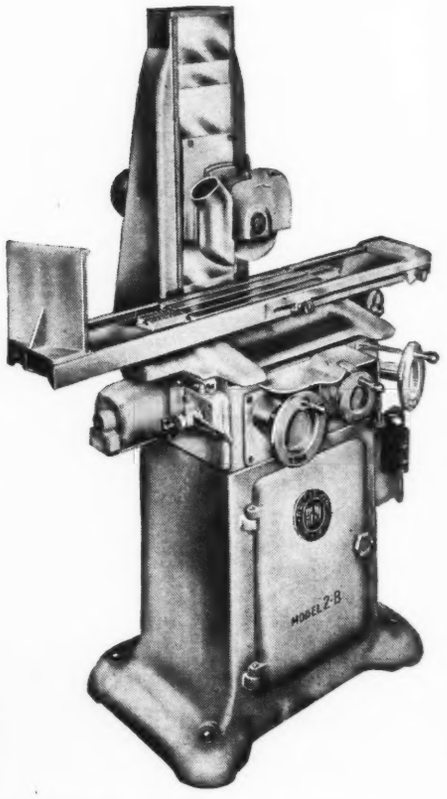
You Will Find Reid Precision Surface Grinders built to handle your work in an efficient and time-saving way. Every possible improvement has been made to assure you close tolerance and a finer finish at lower cost. All working parts are designed and fitted to prevent abrasives from penetrating and causing undue wear. Accessibility and new design of hand wheels assure you accurate fingertip control. An outstanding precision machine with balanced design and attractive finish at moderate cost.

ILLUSTRATED IS THE REID MODEL 2B ALL ELECTRIC POWER-FEED.

The Reid Model 2-C Hand-Feed also is an Exceptionally Fine Machine for Tool, Gage, Die and Certain Production Grinding.

MACHINES EQUIPPED FOR WET GRINDING IF REQUIRED. EXCELLENT DELIVERIES.

Distributors Conveniently Located in All Sections.
Write Dept. B for Illustrated Bulletin and Prices.



REID BROTHERS COMPANY, INC.
BEVERLY MASSACHUSETTS

SECOMET

DIAMOND WHEELS

The full line of JKS Secomet diamond wheels consists of resinoid, metal and vitrified bonded types. In order to produce perfect finishes on carbide tipped tools and other required metal surfaces, diamond powder is evenly graded by a unique JKS scientific process and uniformly distributed throughout the bonds. Select your wheels from Price List No. 45.

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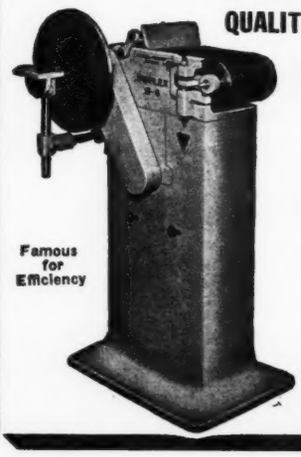
GRINDING WHEEL DRESSING TIPS

THIS IS Diamo-Carbo, the hardest substitute for real diamond dressers made. Filled to the hilt with an abrasive almost as hard as diamonds, it will give a long life of service truing all kinds of wheels. Write for Catalog "A".

The Only Complete Line of Wheel Truing Equipment

DESMOND-STEPHAN MFG. CO., Urbana, O.



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QUALITY • SERVICE • DEPENDABILITY

DUPLEX M-6

HIGH SPEED BAND AND DISC GRINDER

The latest in pedestal type grinders. Actually two machines in one! 14" disc for all rough work . . . 6 x 48" band for finishing. Precision-built to post war standards.

Other styles and sizes in New Booklet on Finishing. Write Today.

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CORRECT GRINDING

with the OLIVER 510 DRILLPOINTER

The Oliver 510 Drillpoint was perfected on the theory that Twist Drills should always be machine sharpened for efficient production. When properly machine ground a Twist Drill will cut faster, last longer and produce more holes per grind.

Excessive costs of scrap materials and tools have been eliminated by use of the Oliver of Adrian Drillpointer.

OLIVER'S 510 DRILLPOINTER

covers the entire range of drills from 1/4" to 3", with variable clearance and point angles, providing points that give greater clearance with less chisel point angle . . . thrust is reduced . . . uniformity maintained . . . each drill point is exactly the same as every other drill point.

OLIVER OF ADRIAN PRODUCTS

Don't Neglect Your Toolroom It's the Backbone of Production!

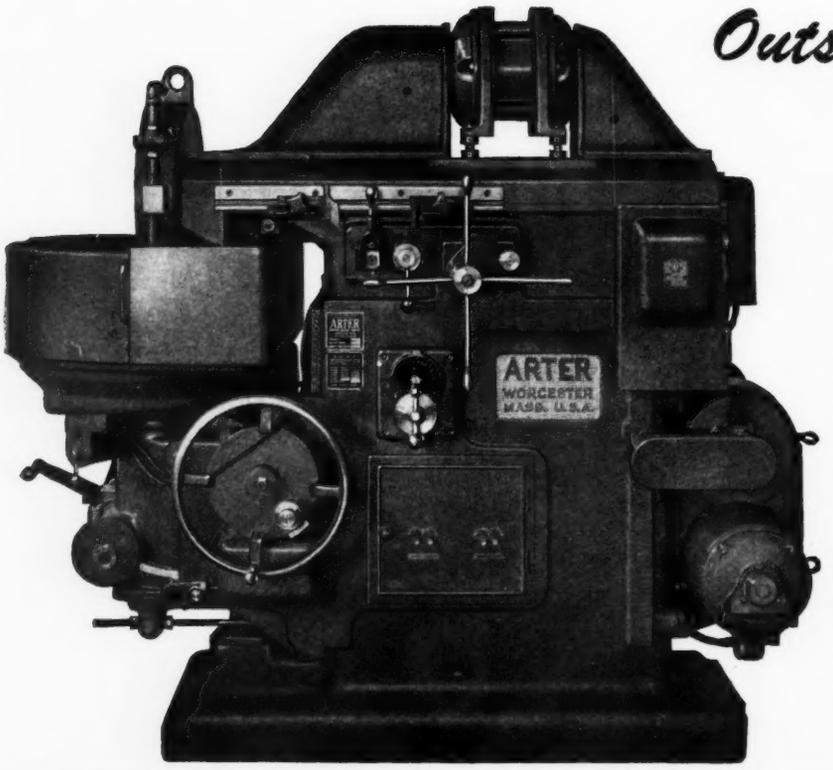
OLIVER INSTRUMENT CO.
1410 E. Maumee St.
Adrian, Mich.

•

Write for Illustrated Literature

Oliver OF ADRIAN

AUTOMATIC DRILL GRINDERS—TOOL AND CUTTER GRINDERS—DRILL POINT THINNERS—TEMPLATE TOOL GRINDERS—FACE MILL GRINDERS—DIEMAKING MACHINES



Outstanding Advance

ARTER

Model D 12" and 16" Rotary Surface Grinders

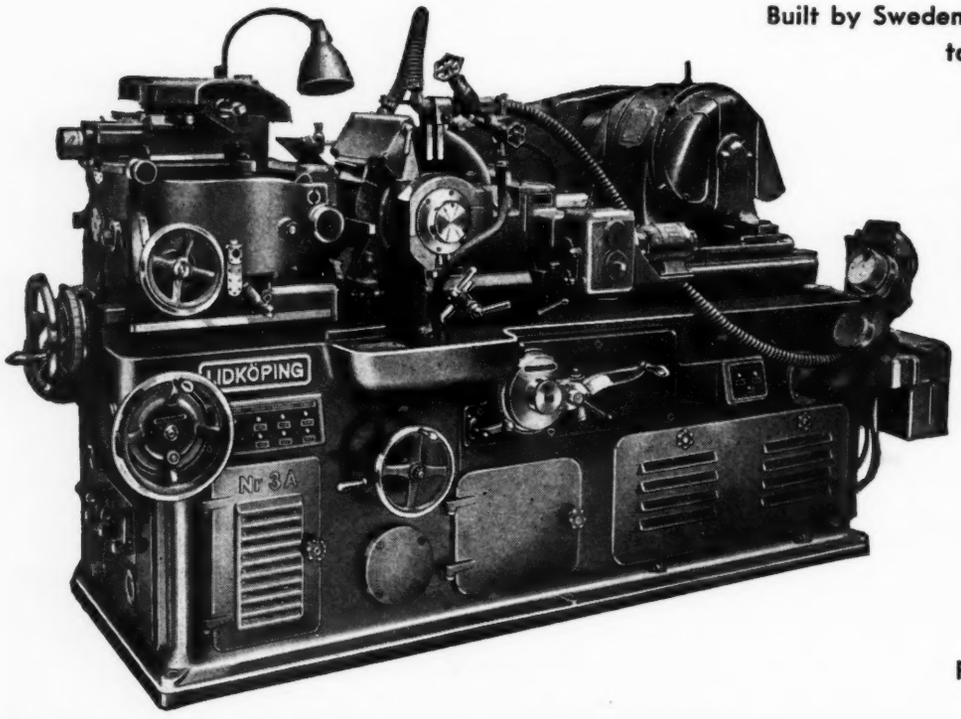
This outstanding advance, held back by war restrictions, is now generally available. Improvements and refinements insure work being ground to extreme precision and high finish to meet the exacting demands of industry today.

Wheel slide hydraulically operated, with piston rod and wheel spindle axis level with the longer, front extended, widened ways, gives smoothness to the traverse and stability to the spindle. Chuck spindle mounted top and bottom in double-row, precision, preloaded ball bearings, driven by V belts from electric motor varispeed drive unit.

ARTER GRINDING MACHINE COMPANY

WORCESTER, MASSACHUSETTS • U. S. A.

SWEDISH LIDKÖPING CENTERLESS GRINDERS



Built by Sweden's oldest and largest machine tool factory. Hundreds in use.

Most powerful.

Many sizes available for grinding pieces up to 14" diameter, 23" long; for grinding bars up to 6" diameter and 25 ft. long.

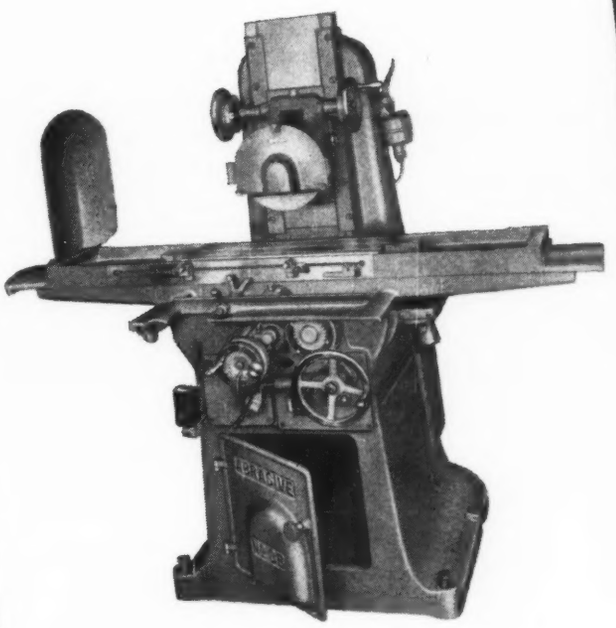
Large variety of attachments available for:

Through-Feed
In-Feed
Profile
Taper and
Shoulder Grinding

For detailed catalog write to:

TRIPLEX MACHINE TOOL CORP., 125 Barclay Street, New York 7, N. Y.

ABRASIVE 3-B SURFACE GRINDER



This modern, automatic feed surface grinder has ample work ability to meet the heavy production schedules of competitive manufacturing. Its smooth action and perfect control count today where exceptional accuracy, fine finish and high production are essential. Write for Bulletin.

ABRASIVE
ACCURACY BOOSTS PRODUCTION

ABRASIVE MACHINE TOOL CO.
EAST PROVIDENCE 14, RHODE ISLAND
Dealers in Principal Cities

SEE OUR CATALOG IN SWEETS FILE

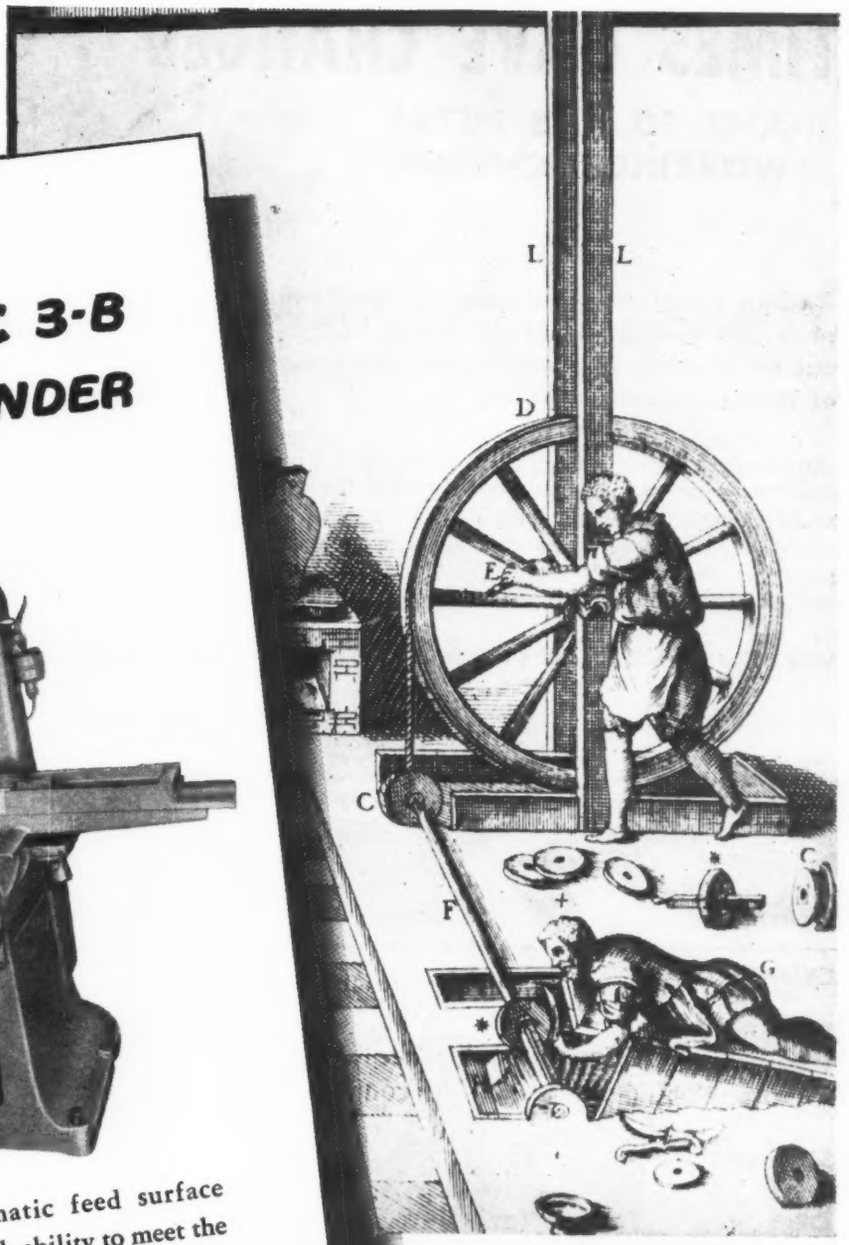


Illustration from Bettman Archive

LYING DOWN ON THE JOB THREE CENTURIES AGO

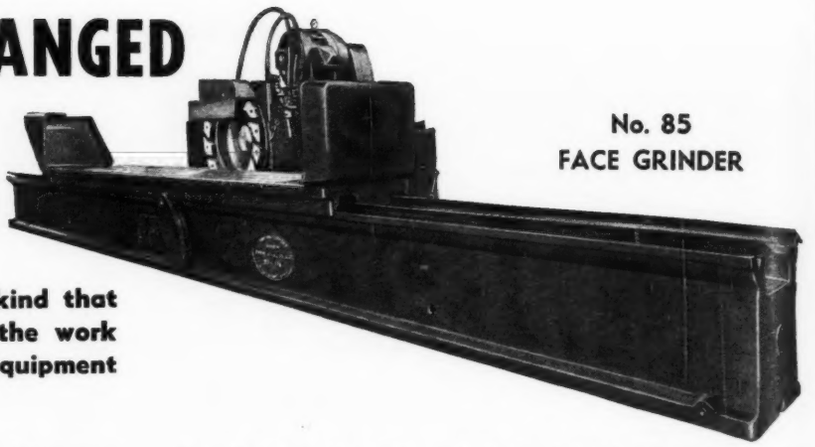
It was really a grind to produce knives and tools in this 17th century shop. The comfort of the machine operator was of no consequence and production was a creaking, time-consuming process.

The Government Machine Tool Surplus Lists may include ABRASIVE Machines to replace your obsolete machinery. Send us the machine serial number for any desired information; we will endeavor to provide attachments, accessories and repair parts as required.

TIMES HAVE CHANGED

AND SO HAS METAL WORKING TECHNIQUE

!



No. 85
FACE GRINDER

Modern metal working practice—the kind that pays substantial dividends and gets the work out on schedule—is possible only with equipment of high productive capacity.

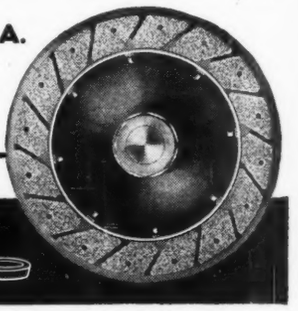
"Bridgeport" Face Grinders are definitely *high production equipment.* Here are some of the things which make them a long-time, dividend-paying investment: long-lived, smooth running Timken bearings of generous proportions, cooling systems of advanced design, extreme ruggedness without excess bulk, handier location of controls and better access to the work, maximum economy of floor space, full streamlines for better appearance, easier cleaning, greater personal safety.

Describe your metal-removal problem and our engineers will gladly make recommendations.

THE BRIDGEPORT SAFETY EMERY WHEEL CO., INC., BRIDGEPORT, CONN., U.S.A.

Bridgeport

GRINDERS • GRINDING WHEELS • BUFFING LATHES



CYLINDRICAL FINISHING

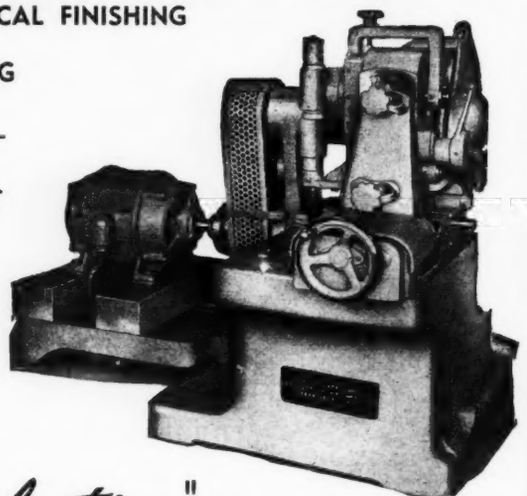
POLISHING

BUFFING –

STRAIGHT

OR

TAPERED

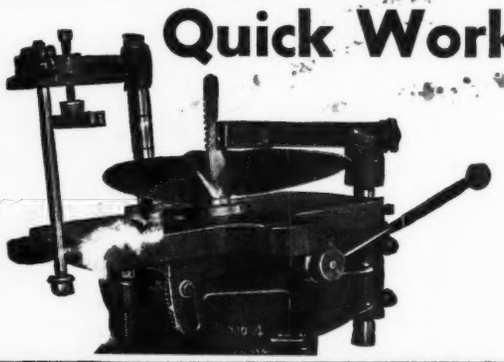


"Production" FOR PRODUCTION!

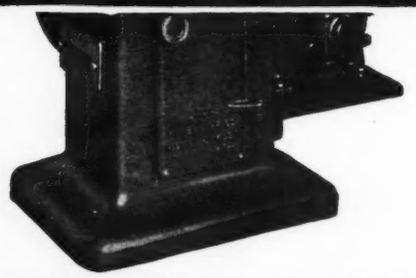
With its variable centerless feed, the "PRODUCTION" No. 101 POLISHING MACHINE enables even unskilled workers to turn out plenty of finely finished round tubes, rods or bars ¼" to 6" in diameter. No centering, no chucking, no holding—just feed automatically. The feed can be varied (forward, reverse or neutral) and two or more machines can be set up in line for multiple operations. Write for full details of this rugged, precision PRODUCER!

Production
MACHINE COMPANY GREENFIELD, MASS. U.S.A.

Quick Work!

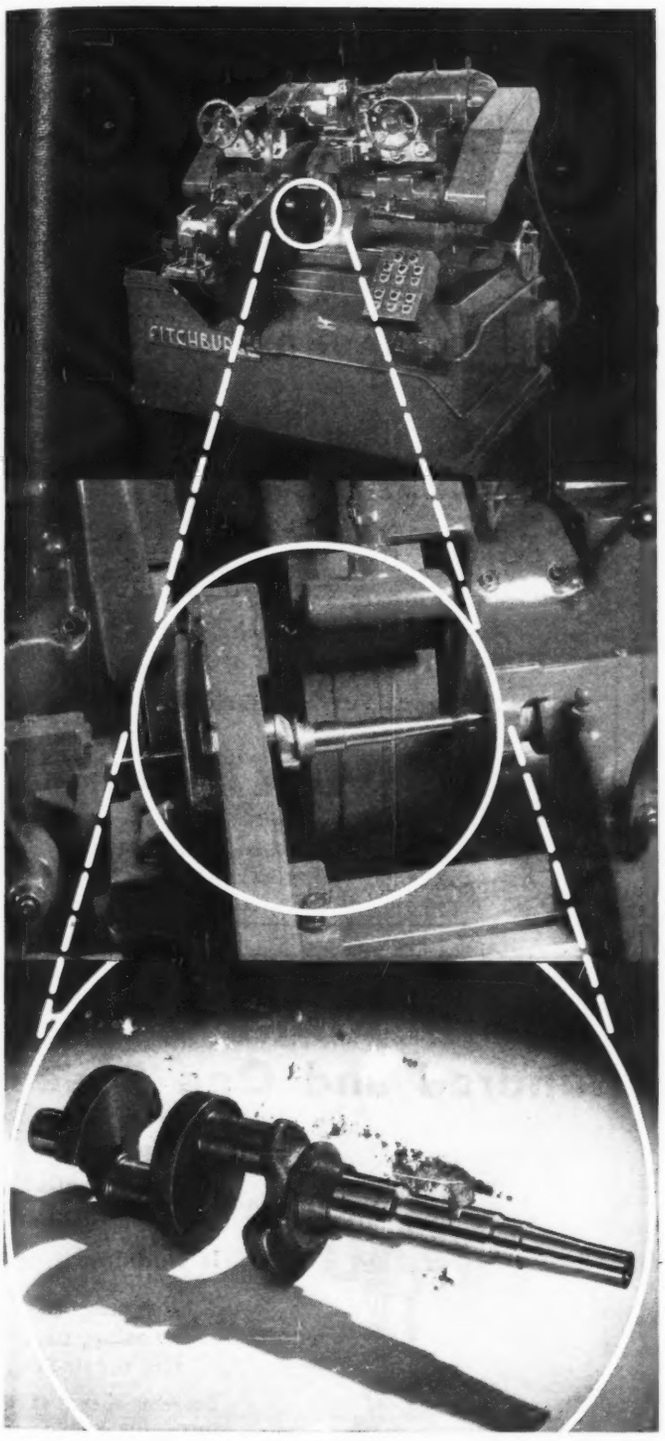


DAVIS KEYSEATERS



Few minutes for setting up, even on tapered work. . . . Rapid, multiple-tooth cutting action that makes a quick job of the largest keyways. . . . High vertical capacity that enables flat work to be stacked for simultaneous cutting. . . . These features make Davis Keyseaters an investment in speed that's worth while investigating. Write for bulletin.

DAVIS KEYSEATER COMPANY
405 Exchange St. ROCHESTER, N. Y.



PRECISION

Grinds 6 Central Diameters at one time!

In this latest example of Fitchburg's specialization in multiple-precision grinding for mass production, two standard automatic-cycle Fitchburg Bowgage Wheelheads are mounted on a special base. A center drive attachment is used.

One form-dressed wheel grinds *five diameters* in a single plunge-cut while the other wheel grinds the sixth diameter.

The operation of the machine is very simple. It consists of loading the work and pressing the start button. The Bowgage Wheelheads go through their automatic cycle simultaneously: rapid traverse to the work . . . proper grinding feed . . . spark out . . . and rapid return—and *all six* diameters are precision-ground with *fine finish* at one time.

All six diameters are ground *within* the time it would ordinarily take to grind *one*. In addition to saving the time required for the five other operations, all the dimensions are accurately controlled in correct relation to each other—thereby greatly reducing the chance for work spoilage.

Fitchburg automatic, multiple-precision, mass-production grinding equipment is saving hours and dollars in many large and small industrial plants.

Call on the specialized experience of Fitchburg's grinding engineers. They can show you how to dig hidden profits out of your grinding operations. There is no obligation.

Send for new fully illustrated book—write for it on your business letterhead—it will be mailed free.

FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U.S.A.

Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders.

NOW AVAILABLE FOR IMMEDIATE DELIVERY

THE *New* CLEVELAND INDEX HEAD

Regrind YOUR TOOLS IN EXACT CONCENTRICITY ON ANY SURFACE GRINDER

DESIGNED TO HOLD ALL TOOLS WITH STRAIGHT OR TAPER SHANKS FROM 1/16" To and incl. 1-1/2" Diam.

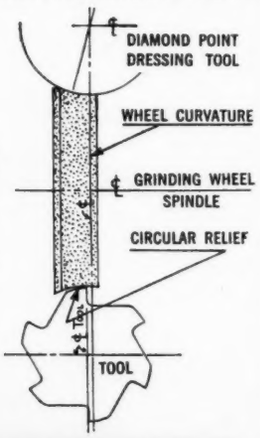
No longer need you discard your taps, reamers, end mills, etc., when they become worn or damaged.

360 degree graduations in three planes enable you to grind any desired angle or cutting edge on your tools with factory precision . . . in your own shop . . . on any surface grinder.

Write for catalog and complete information. See for yourself how you can reduce your tool maintenance costs with the Cleveland Index Head.

CIRCULAR RELIEF GRINDING . . .

A new method for regrinding tools. *Leaves No Land.* Ideal for spiral reamers, bent shank taps, end mills, etc. Complete data and information on request.



Write Today

1259 WEST 4th STREET

GRINDERS & FIXTURES Inc.

Cleveland 13, Ohio

CJK

Specialists in Tooling

NEW BRITAIN GRIDLEY
Chuckers, Screw Machines

HEALD
Bore-Matics, Surface Grinders

CONE
Automatic Screw Machines

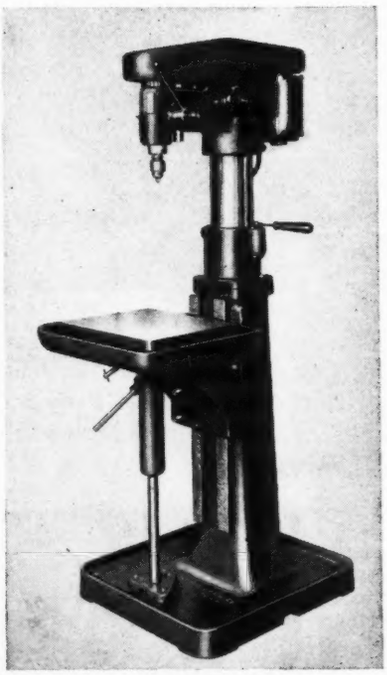
BLANCHARD
Vertical Surface Grinders

C. K. JONES, INC.

Designers of Special Machinery and Tools

SPRINGFIELD 3, MASSACHUSETTS

The Drill with a Hundred and One Speeds



All Speeds Instantly Available While Machine Is Running

M-125—⅜ Cap.
M-96—⅞ Cap.
1 to 6 Spindles.

Correct speed at the turn of a knob.

Speed Chart on front of head.

Ability to obtain exact speed for diameter of drill and material to be used results in less breakage, fewer grinds and higher efficiency.

•

Write for Circulars.

MM-125 MM-96

THE TAYLOR & FENN CO., Hartford, Conn.

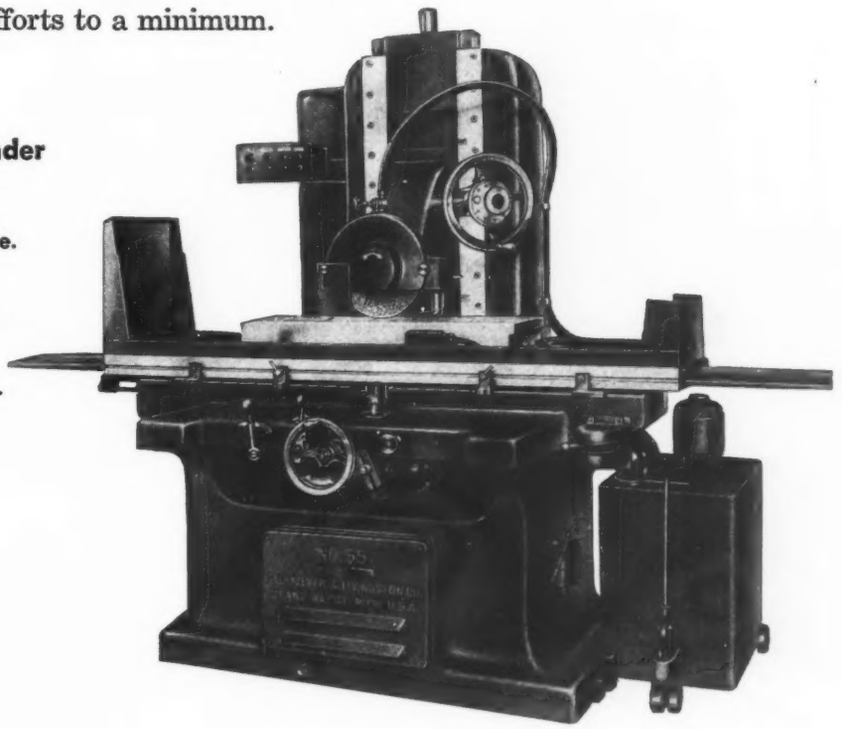
FASTER PRECISION PRODUCTION

125 feet per minute longitudinal table speed with G & L's GRAND RAPIDS No. 55 Surface Grinder

Only GRAND RAPIDS Hydraulic Feed Surface Grinders provide such exceptional table speed. Both the longitudinal table travel and the cross feed are automatic, hydraulically actuated. The wheel head is powered for rapid vertical travel. Automatic and powered movements of the Grand Rapids 55 cut the operator's efforts to a minimum. Magnetic chucks are available.

The Grand Rapids No. 55 Surface Grinder combines ALL these advantages:

- ★ Longitudinal table speed of 125 feet per minute.
- ★ Integral cast column and base assures permanent alignment of vertical head ways and cross saddle ways.
- ★ Starters, controls and motors easily accessible.
- ★ Two spindle speeds, reduce wheel costs.
- ★ Patented vertical movement of wheel head.
- ★ Bijur one-shot lubrication system.
- ★ Special G & L spindle motor end-bells and over-size precision ball bearings.
- ★ Vickers vane type hydraulic pump.
- ★ Portable, self-contained motor-driven coolant system.



GRAND RAPIDS
MANUFACTURED BY
GALLMEYER & LIVINGSTON CO.
GRAND RAPIDS, MICHIGAN, U.S.A.

SPECIFICATIONS:

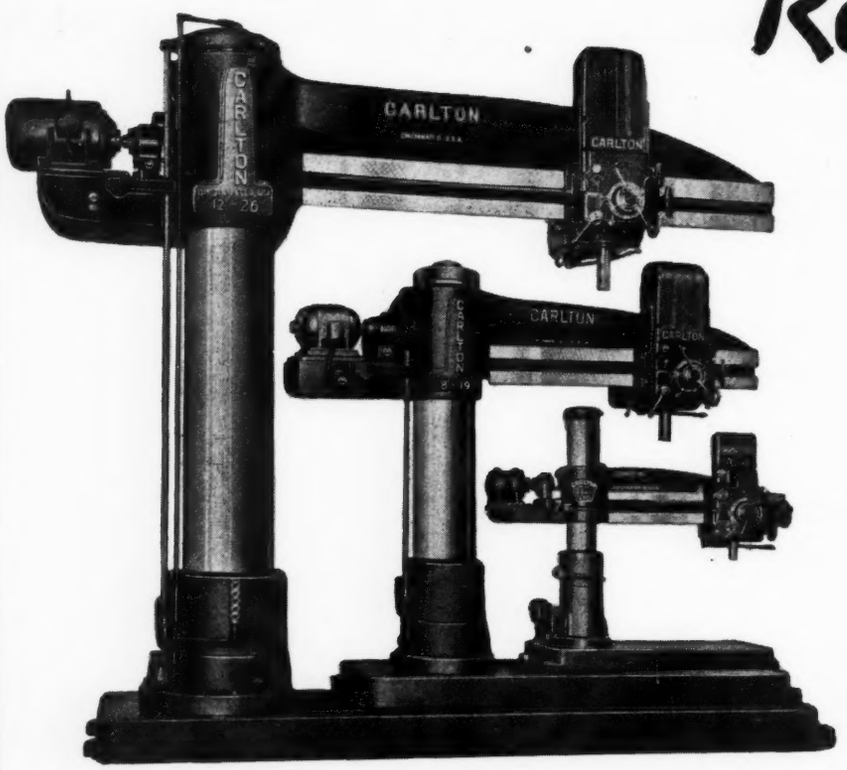
Automatic Table Travel—longitudinal 38″, transverse 13½″.
Working surface of table—12″ x 36″.
Standard wheel size—12″ x 1″ x 3″.
Vertical movement of wheel head—18″.
Spindle speeds—1925 and 2500 RPM.
Floor space—150″ wide x 102″ deep.

Write for catalog GL 101

What "GRAND RAPIDS" Quality Means: G & L cast their own close-grained gray iron, machine all parts to micrometric tolerances, and precision-assemble grinding machinery of unsurpassed performance. *Grand Rapids* means *top* quality in Hydraulic Feed Surface Grinders.

GALLMEYER & LIVINGSTON COMPANY, 305 STRAIGHT ST., S. W., GRAND RAPIDS 4, MICH.

CARLTON Radials



The Carlton Machine Tool Co. offers a complete line of Radial Drilling Machines in sizes ranging from 3′ arm to 12′ arm, and from 9″ dia. column to 26″ dia. column. Carlton Radials are delivering outstanding service in almost every large manufacturing plant in the country, as well as railroad shops, shipyards, steel mills, etc. Carlton all-ball-bearing construction with original low-hung drive to spindle makes operation—even under heavy loads — smooth, vibrationless and chatter-proof. Many other modern features available. For greater production, greater economy and satisfaction . . . . investigate Carlton Radials today!

THE CARLTON MACHINE TOOL CO.
CINCINNATI, OHIO

for Continuous
HIGH DUTY PRODUCTION

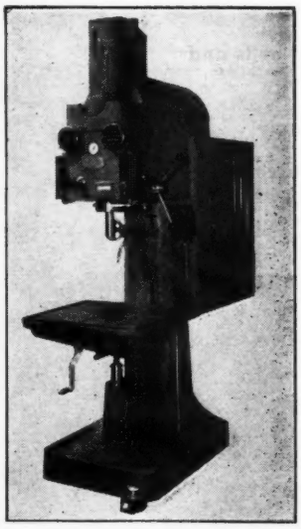
Kaufman No. 10A Hi-Duty single spindle. Lead Screw Tapper made in 3 HP and 1½ HP models, with ¾″ N.C. and 1⅛″ N.C. Threads in alloy steel offers these features:

Fully enclosed . . . lead screw and nut operate constantly in oil bath . . . positively wear-proof clutches instantly engaged and controlled by air cylinder . . . quick traverse when not actually cutting threads . . . accurate depth control . . . control to protect tap overload, and further protected against jamming if work is placed in upside down . . . class 3 fits always assured and perfectly controllable.

KAUFMAN MFG. CO.
MANITOWOC, WISCONSIN

COMPLETE INFORMATION UPON REQUEST

Better TAPPING Faster



on a Model DB
CLEVELAND Automatic Tapping Machine

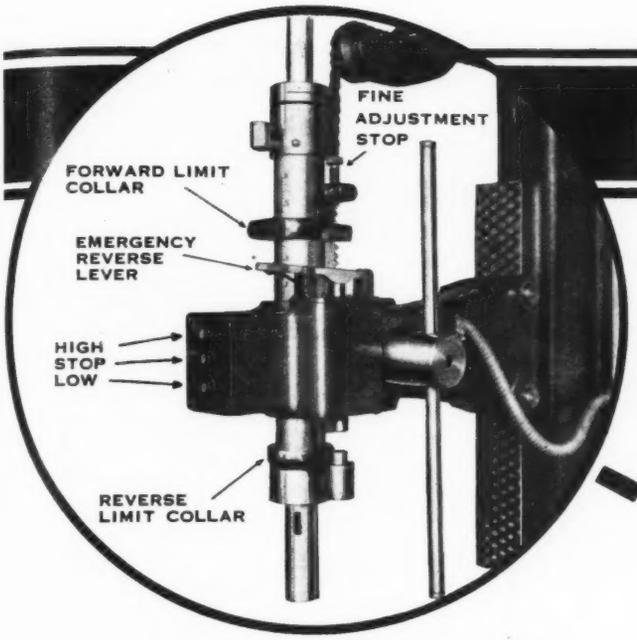
Give your tap a chance to produce better threads. Our lead screw completely controls the thread accuracy through the entire tapping cycle, taking the load off the tap—Class 3, 4 and 5 gauge fits are therefore being produced on a production basis.

Five Outstanding Features

- LEAD SCREW CONTROLLED
- 100 PER CENT AUTOMATIC
- PRECISION DEPTH STOP
- SENSITIVE SLIP CLUTCH
- SPLIT SECOND REVERSE

Full Descriptive bulletin available. Write for your copy today.

CLEVELAND
LEAD SCREW
TAPPING MACHINES
★
THE CLEVELAND TAPPING MACHINE CO.
3610 SUPERIOR AVE., CLEVELAND 14, OHIO



Avey FEATURE No. 1

THE Avey TYPE MA-6

AVEY-MATIC POWER FED HAND FEED AND REVERSING MOTOR TAPPING MACHINE

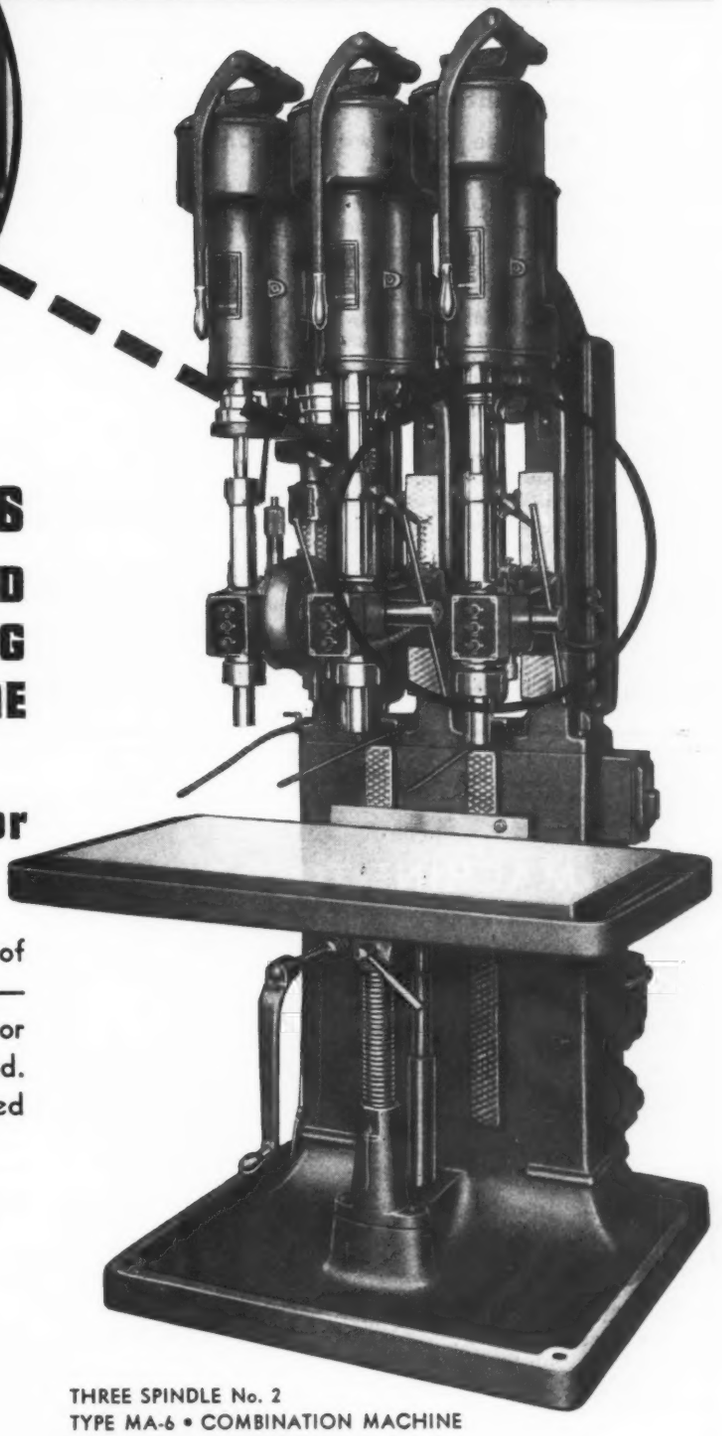
features

hand feed reversing motor for tapping

Dog control for depth — maintaining accuracy of depth within one-half revolution of the spindle — or emergency relief lever used to reverse motor if necessary before tapping cycle is completed. The natural motion of the spindle sleeve is used to control the reversing of the motor.

Type MA-6 is made in following capacities:
No. 2 — 7/8" capacity in cast iron.
No. 3 — 1 1/4" capacity in cast iron.

THE AVEY DRILLING MACHINE CO.
CINCINNATI • OHIO • U. S. A.



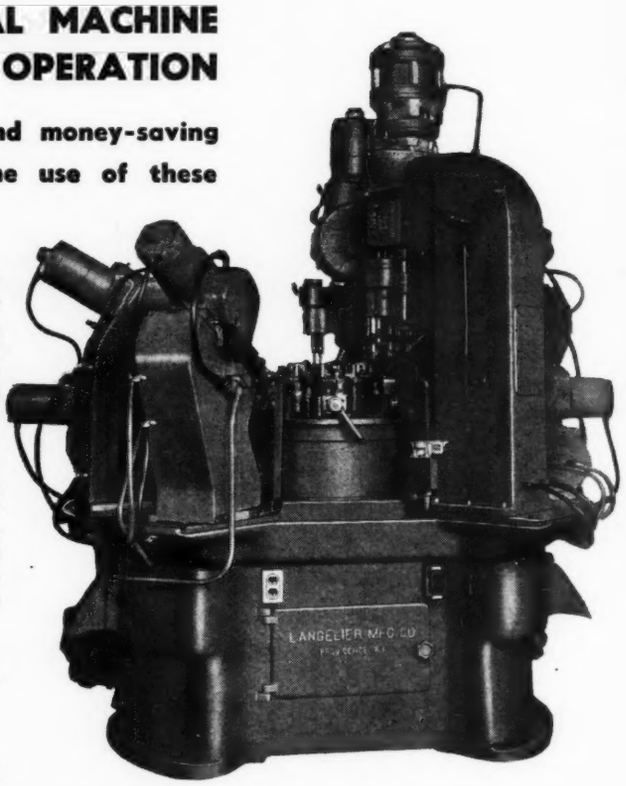
THREE SPINDLE No. 2
TYPE MA-6 • COMBINATION MACHINE
1st Spindle - Avey-matic Feed
2nd Spindle - Hand Feed
3rd Spindle - Tapping (Reversing Motor)

Avey DRILLING MACHINES
CINCINNATI · OHIO

Eleven LANGELIER AUTOMATIC UNITS

. . . BUILT INTO THIS SPECIAL MACHINE FOR HIGH-SPEED AUTOMATIC OPERATION

— and it's typical of the many time- and money-saving possibilities that are YOURS through the use of these versatile metal-working Units!



Langelier Automatic Units are ideally suited to single or multiple applications in the building of Special Machines for high production drilling, tapping, milling, counterboring, reaming, spotting, chamfering, etc. Multiple Spindle attachable Langelier Heads may be mounted on the feed sleeve of each Unit for combinations of these operations. Machine shown at RIGHT has been arranged to perform a series of drilling, counterboring and tapping operations in Carburetor Bodies. Machine features nine Langelier Drilling Units and two Tapping Units. One drilling unit is equipped with four-spindle attachable head, and one tapping unit has eight-spindle attachable head. Eight-station dial indexing mechanism is motor-driven. Entire machine electrically interlocked for fully automatic operation. Our engineering department will gladly make recommendations for machines adapted to YOUR specific requirements. (See also our Swager advertisement in this issue.)

LANGELIER MANUFACTURING CO.

Drilling and Swaging Specialists for
Over 50 Years . . . Incorporated 1887

PROVIDENCE • RHODE ISLAND

TIME-SAVING MACHINE TOOLS SINCE 1901

Moline Tool Company since 1901 has been designing and building machine tools of the highest degree of efficiency for these operations:

- Boring—rough, semi-finish and finish
- Honing
- Milling—(special machines)
- Straight Line Drillers
- Universal adjustable spindle drillers
- Way Type Machines—horizontal and vertical drilling, tapping and boring machines

"Hole Hog" machine tools are versatile—their construction makes possible easy change-over to other jobs. They are easy to operate and are ruggedly built for years of continuous production service. For man-hour savings—for more efficient, smoother work—look to Moline machines.

Write for information concerning machine tool equipment for your special problems.

MOLINE TOOL CO. HOLE HOG MOLINE, ILLINOIS

MOLINE TOOL COMPANY

107 20th Street MOLINE, ILLINOIS

NOW—Streamline Your Welding Procedure

VICTORY *Automatic* Seam Welder

A wartime development — greatly improved — combines HIGH welding output with low operating cost to produce a better product!

Model 0412

CONSIDER these outstanding advantages and you will see why MORE manufacturers using MANY types of seam-welded tubing are adopting the remakable performance of the VICTORY Two-Man *Continuous* Tube Welder:

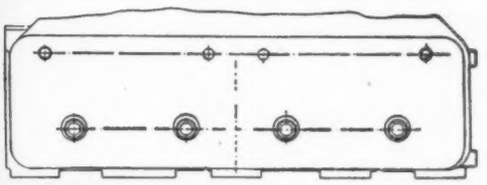
- Delivers up to 150" per minute of uniform, tight, straight welds.
- Takes 4" to 12" dia. pre-formed tubing, 18 ga. to 3/16" wall thickness.
- No splatter of metal—eliminates wasteful weld grinding and finishing.
- Chain-type drive prevents work slippage while passing under welding head.
- Efficiently employs Union Melt, Concealed or Submerged electric arc welding.
- Designed for Rounds, Squares, and other shaped tubes.

Learn more about the VICTORY Automatic Tube Seam Welder. Our engineers will give your inquiries prompt attention . . . show you how to get better welded tubing . . . faster, and at lower cost!

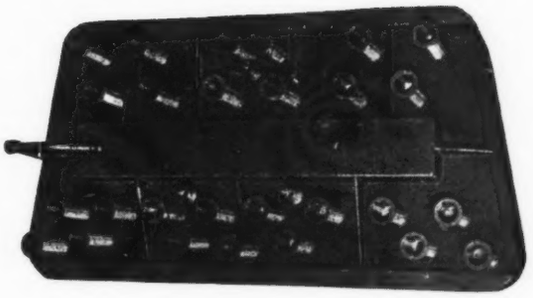
VICTORY ENGINEERING & MACHINE WORKS, INC.

3000 Chouteau Ave., St. Louis 3, Mo.

Special HOEFER Unit
• • DRILLS AND REAMS THREE DIFFERENT CYLINDER HEAD PARTS



• Typical Diesel Cylinder Head layout drilled and reamed 51 feet per minute, 286 r.p.m., .010-inch feed, 1½ travel—requires only 31 seconds total time.



★ This interesting 27-spindle full anti-friction head, with three groups of spindles is capable of being driven in individual groups by engaging drive through one of the three gear shift buttons shown. Forced cascaded lubrication provided in head which was driven by vertical hydraulic feed driller. This head in combination with the fixture we furnished drills the bolt holes in three different sizes of Diesel engine cylinder heads.

This Hoefer Multiple Spindle Head is an example of the ability of Hoefer engineers to meet the most unusual hole drilling requirements giving you a simplified method and one that ensures time and cost savings. Hoefer Heads are attachable to your own drill presses or turret lathes. Among the benefits are savings in floor space as well as the cost of new machinery. Having designed thousands of heads our engineers can easily develop a multiple drilling head to fully meet your specific needs. Write, telling us about your job.

Hoefer's Whole Business is Holes • • • •

HOEFER MFG. CO. *Freeport, Ill.*

Sensitive Tapping Head for Fast, Accurate Tapping

- **Cover clamping eliminates chatter**
- **Rigid mounting reduces vibration**

The Procunier cover clamping tapping head is ideal for light, sensitive drill presses. It clamps directly to the drill press quill for greater rigidity and freedom from chatter. Vibration and the tendency to "run-cut" or "bell mouth" is minimized because of the short, rigid mounting.

Procunier Sensitive Hi-Speed Tap Heads are precision built for accurate tapping at high speeds. Driven by a double-cone, cork-faced friction clutch, the tap is protected by a soft "cushion" effect. The operator can quickly detect the presence of a dull or "loaded" tap by the amount of pressure needed to drive the tap. Bottom tapping is done as easily as through tapping, since the clutch instantly slips should the tap strike bottom or stick due to tap loading.

Send coupon today for bulletin giving full details, specifications and prices.

"TRU-GRIP" TAP HOLDER

The new "Tru-Grip" is a smaller, lighter and more accurate tap holder. A broached section in the chuck receives the flattened surfaces on the spring collet, while the tap has a positive drive through the square hole in the collet. The tap is held in alignment by the round and driven by the square — taps are never scored or "chewed up."

FAST, ACCURATE EXTERNAL THREADING WITH ACORN DIES

Do external threading jobs faster with a Procunier Tapping Head which holds standard Acorn dies. Cut external threads quickly in brass, die castings and aluminum.

PROCUNIER SAFETY CHUCK CO.

16 S. CLINTON STREET CHICAGO 3, ILL.

MAIL THIS TODAY

PROCUNIER SAFETY CHUCK CO.
16 S. Clinton St., Chicago 3, Ill.

Send me bulletins on ☐ Procunier High Speed Tapping Heads ☐ Tru-Grip Tap Holders ☐ Universal Tapping Machines.

Name.....

Address.....

City.....State.....

.....

PACEMAKERS OF PRODUCTION!

DESIGNED AND BUILT BY BUHR FOR MULTIPLE OPERATIONS

Retooling old machinery for modern production lines is no problem for Buhr Engineers are specialists on multiple-spindle drilling, reaming and tapping operations. Many seemingly impossible production problems have been solved quickly by our staff of qualified men.

TYPICAL BUHR RETOOLING

1—24 Spindle Drill Head arranged with 12 Spindles for Drilling and 12 Spindles for Reaming.

1—2 Compartment Bushing Plate with automatic cut-off of compound in non-operating position.

1—Holding Fixture mounted on rolling type index. Loading position left, drilling center and reaming position right.

All gears in Buhr Drill Heads are shaved and induction hardened for quieter, frictionless operation, lower power consumption and more trouble-free production hours.

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Solves many problems in case-hardening light sections made from mild steels

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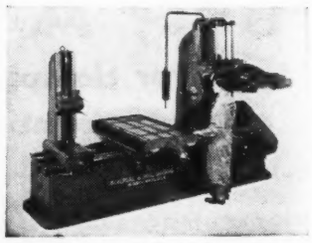
The only **TRIWAY** Boring Machine Built

Made in 3", 4" and 5" spindle sizes. Write for complete, detailed specifications. Represented throughout South America by Machine Affiliates.



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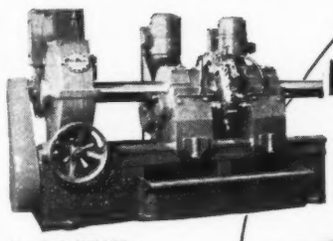

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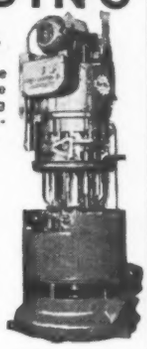
Open side, as well as, those with a combination of Vertical and Horizontal Heads are incorporated in this line.

8 SV VERTICAL DRILLER
Operations are continuous of the non-indexing type. 8 or 10 spindles available.



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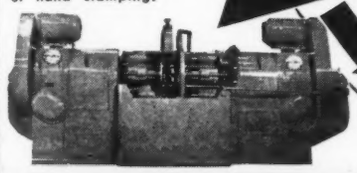
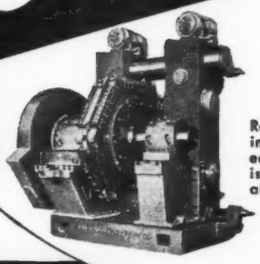
One of a series of continuous operating milling machines adaptable to automatic or hand clamping.

DOUBLE END HORIZONTAL DRILLER
12 to 24 Spindles—self feeding—continuous operation—automatic chain or hand clamping.





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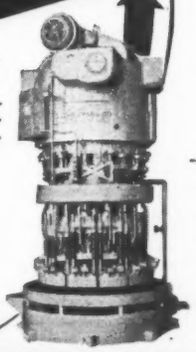
Continuous operating having a capacity of 1½ in. in steel.



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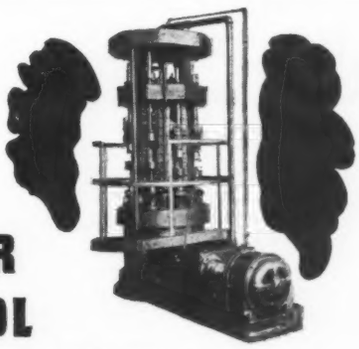

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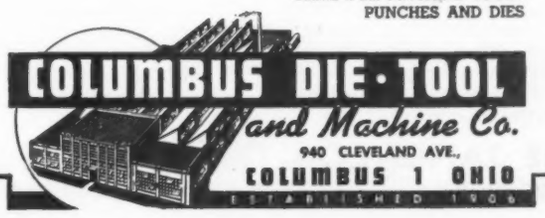

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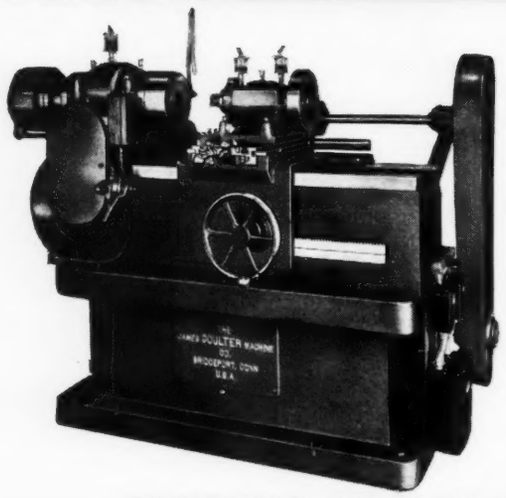

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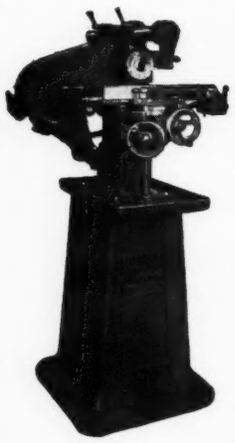

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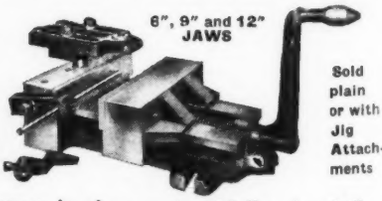

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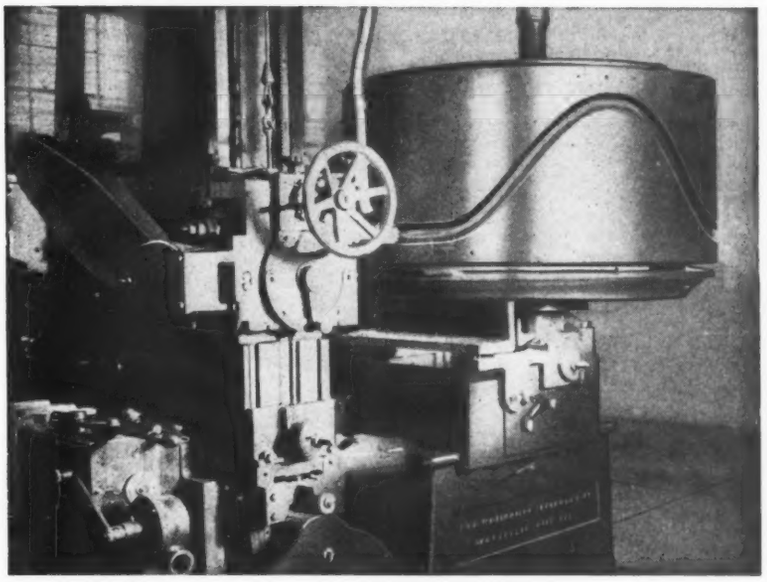

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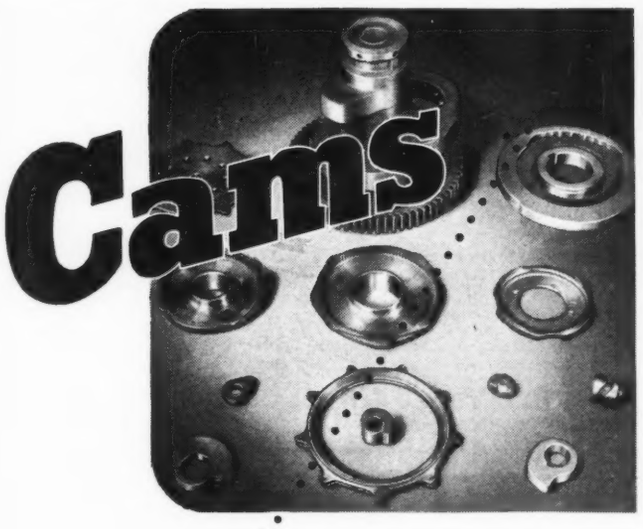

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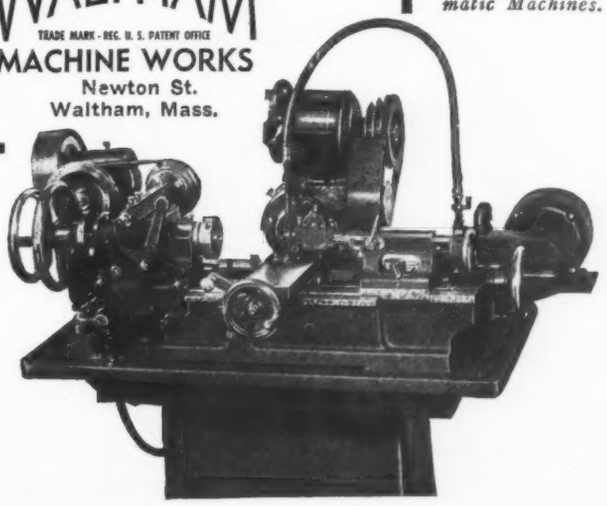

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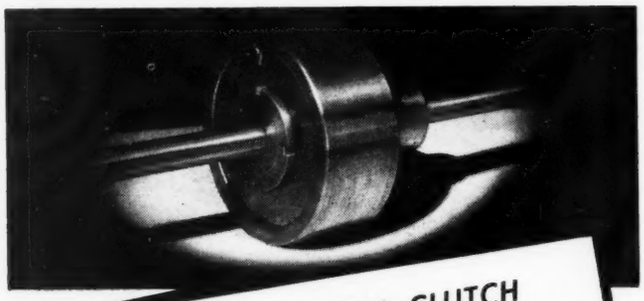
ARE EXCELLENT FOR ALL CLASSES OF MACHINERY



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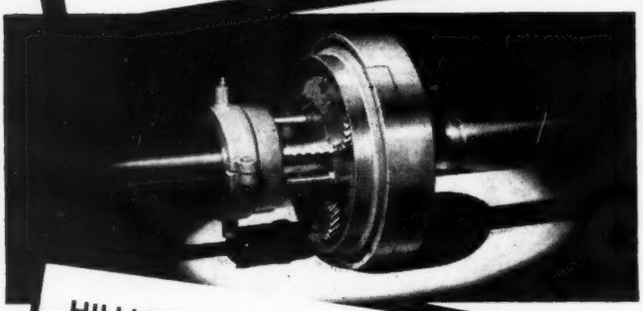

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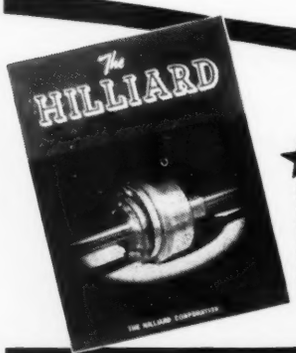

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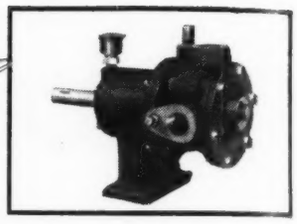

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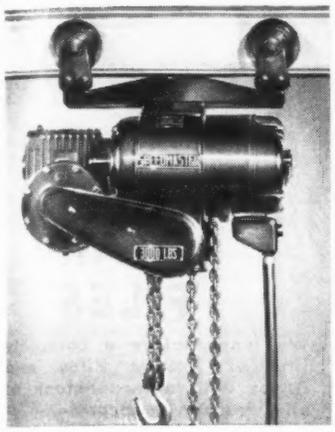

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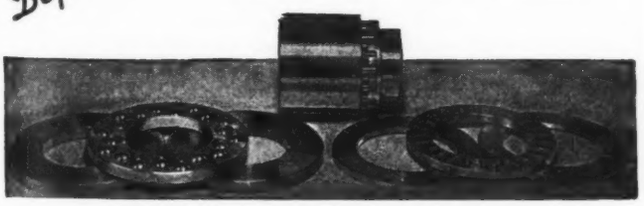

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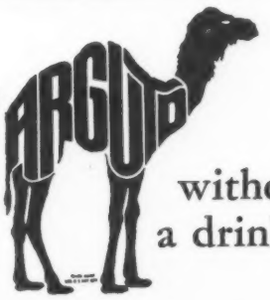

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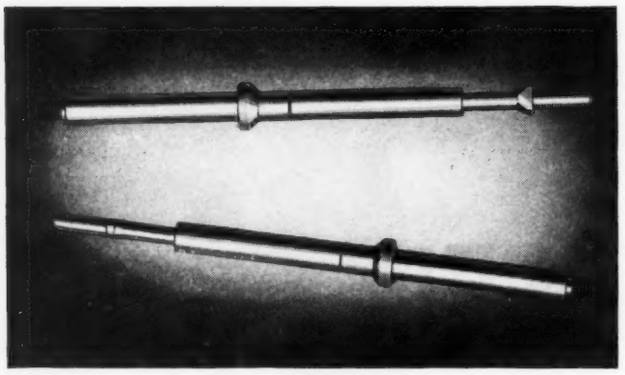

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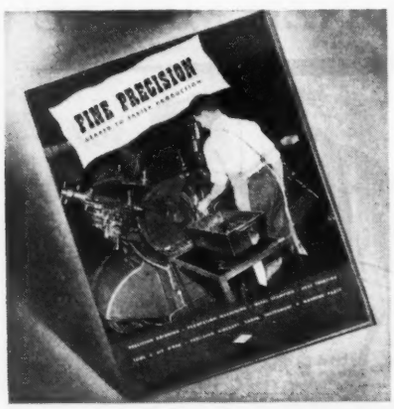

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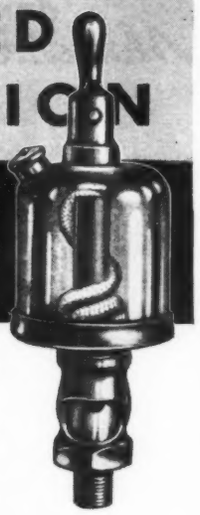
GITS Wick Feed Oilers



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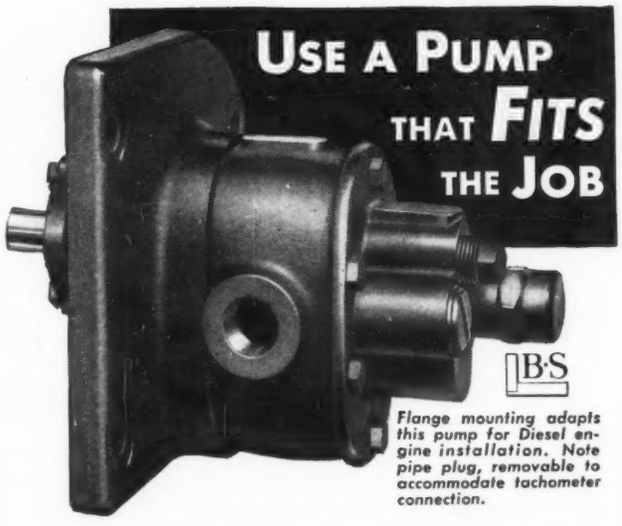

Flange mounting adapts this pump for Diesel engine installation. Note pipe plug, removable to accommodate tachometer connection.

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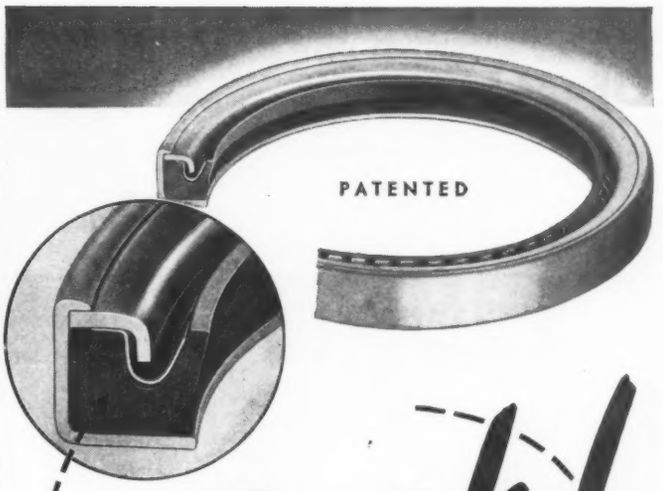

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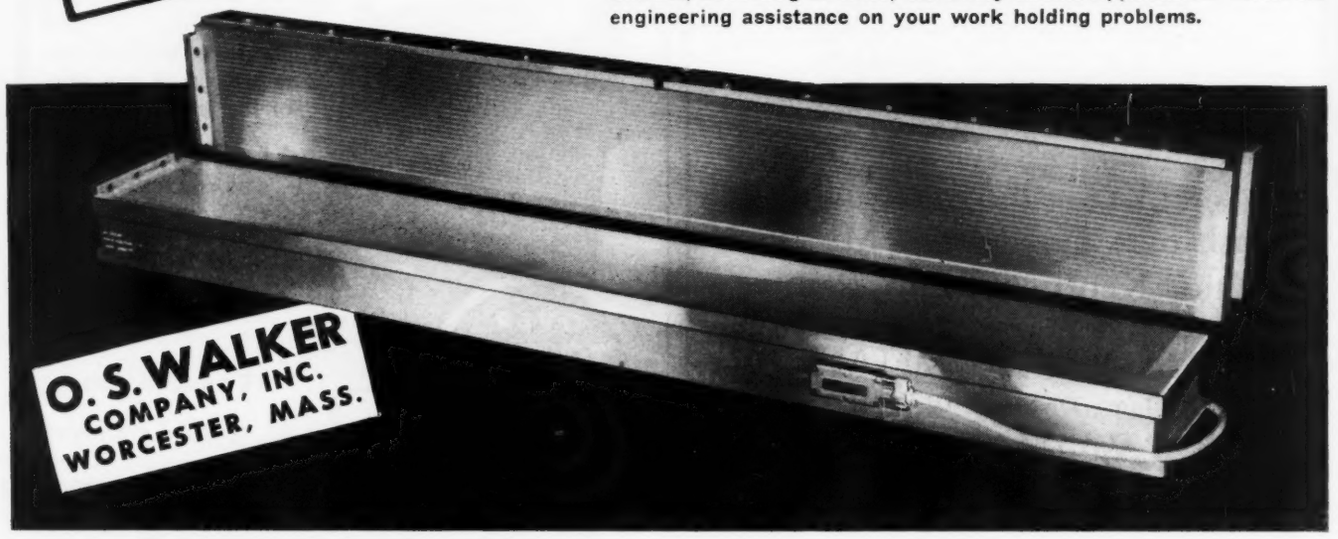

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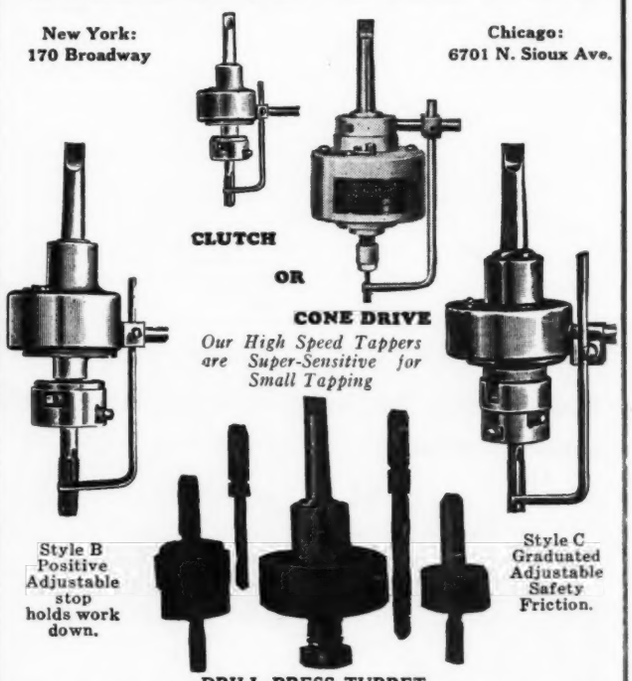

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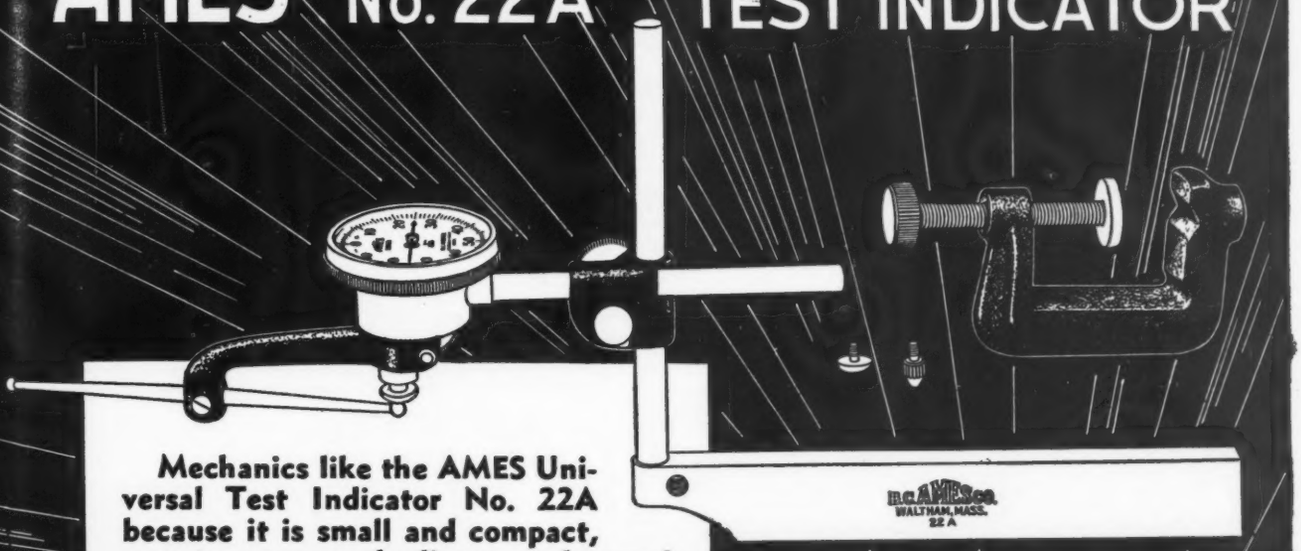

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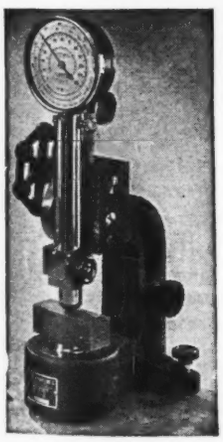

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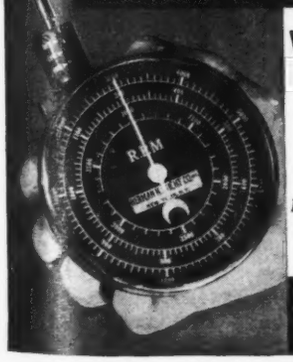

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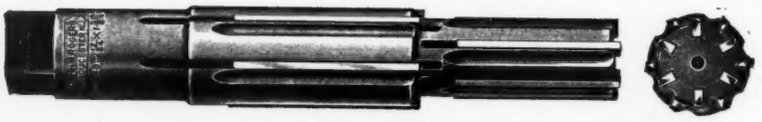

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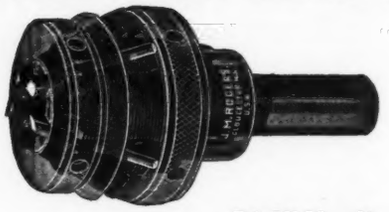

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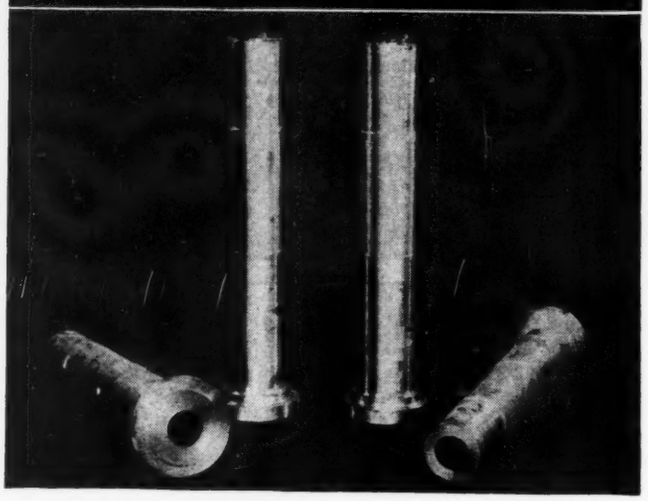

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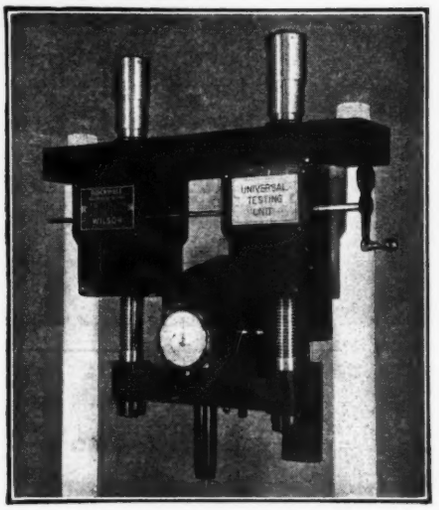

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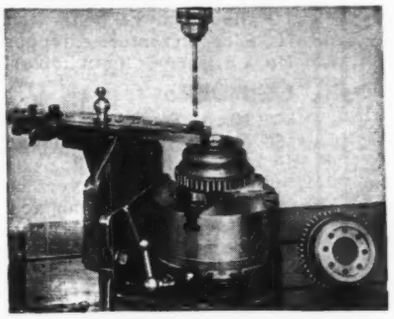

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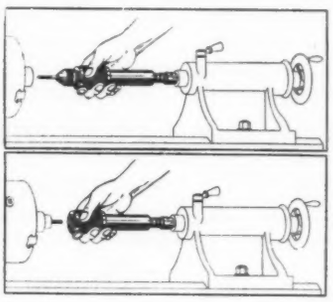

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14"x18" Monarch Magnamatic.
14"x19" Fay automatic.
15"x22½" Sundstrand auto. stub.
8"x12" Sundstrand stub.

MILLERS

No. 5 Cincinnati High Power.
Nos. 2B & 3B Milwaukee plain.
No. 35 Ohio universal.
No. 2 Cincinnati dial type vertical.
No. 2 Brown & Sharpe vertical.
No. 2½B Milwaukee vertical.
No. 4—36 Cincinnati Hydromatic.
30" & 48" Newton rotary.

SHAPERS & PLANERS

6" Pratt & Whitney vertical shaper.
20" Ohio shaper.
16" & 24" G. & E. shapers.
32" Morton draw cut shaper.
24"x24"x6' Ohio planer.
30"x30"x12' Cleveland openside.
32"x32"x8' Cincinnati planer.

SEND FOR COMPLETE LIST.

Miles Machinery Co.

Saginaw, Mich.

WANTED
Mechanical Engineer

Must have intensive experience in the designing and production of screw pumps. Write names and addresses of all former employers; age; salary desired. Box No. 337, MACHINERY, 148 Lafayette Street, New York 13, N. Y.

PERSONNEL DIRECTOR

Unusual opportunity awaits capable man with broad experience in all phases of employee relations who is interested in permanent association with successful organization building high grade equipment.

This is a new position created to coordinate all employee activities including Employment, Labor Relations, Training, Athletic Activities, Safety and Welfare Work, Pensions, Group Insurance and Benefits, etc.

Qualifications in addition to broad personnel experience should include sound judgment, initiative and ability to assume responsibility.

Plant is modern and company progressive. It has highest financial rating and is leader in its field.

Applications will be considered confidential and should give in first letter full particulars as to experience and qualifications, age, references, compensation, etc.

Address Box No. 354, MACHINERY, 148 Lafayette St., New York 13, N. Y.

MANUFACTURERS' REPRESENTATIVE
CLEVELAND AND VICINITY

Resident of this area for past 15 years, with 25 years Tool Engineering experience, invites correspondence with manufacturers of tools and machines salable to the machine tool industry IN NORTHERN OHIO. Box No. 360, MACHINERY, 148 Lafayette Street, New York 13, N. Y.

WANTED

MACHINE SHOP FOREMAN. Must have 15 to 20 years' practical shop experience in general work, repairs and building special machinery, and at least 3 years' technical education. State experience, references and salary expected in first letter. A modern, up-to-date shop located in the Cleveland area. Box No. 356, MACHINERY, 148 Lafayette Street, New York 13, N. Y.

SIMMONS BEST BUYS

BORING MILLS

24" BULLARD New Era Vertical with one swiveling turret head and one side head. AC or DC motor drive.

42" BULLARD New Era Vertical with one swiveling turret head and one side head. AC or DC motor drive.

53" NILES-BEMENT-POND, 2 swivel heads, all geared feeds, M.D.

60" KING, 2 swivel heads, all geared feeds, M.D.

72" COLBURN Vertical with 2 swivel heads on rail, Power Rapid Traverse.

84" CINCINNATI Vertical, 1-swivel head, 1-turret head, all geared feeds, motor drive.

120" CINCINNATI Massive Pattern Vertical with two swiveling heads. Power Rapid Traverse. AC or DC.

120" NILES - BEMENT - POND heavy, two swivel heads, all geared feeds, Power Rapid Traverse.

14-20' NILES-BEMENT-POND heavy extension type, all geared feeds, M.D.

3" Bar Universal TRI-WAY horizontal table type boring, 32"x58" table.

4½" Bar NILES - BEMENT - POND Horizontal table type boring, drilling and milling machine, all geared feeds, AC or DC drive.

No. 1 4" Bar DETRICK and HARVEY floor type horizontal boring, drilling and milling machine. AC or DC.

5½" Bar NILES - BEMENT - POND Heavy floor Type Horizontal Boring, Drilling, Milling Machine. AC or DC motor drive.

JIG BORER

NO. 2 PRATT & WHITNEY Jig Boring Machine, with 22" x 44" table, self-contained, motor drive.

RADIAL DRILLS

4' AMERICAN plain triple purpose enclosed head drill with tapping attachment. Single pulley belt drive or AC or DC.

5½' AMERICAN Full Universal Triple Geared with tapping attachment. Single pulley belt drive or AC or DC motor drive.

6' AMERICAN triple purpose, motor on arm, tapping attachment.

8' NILES - BEMENT - POND "Right Line" Plain with 230 volt DC motor on arm, tapping attachment.

GEAR HOBBER

100" GOULD & EBERHARDT Horizontal for spur, helical and worm gear. Maximum capacity 101" diameter, 48" face. Forced feed lubrication.

GRINDERS

24"x20' Centers NORTON Plain Cylindrical.

NO. 2 CINCINNATI Centerless.

NO. 2 CINCINNATI Universal Cylindrical.

24"x20' Centers NORTON Plain, Cylindrical, individual motor drive to work spindle, wheel spindle and table.

TURRET LATHES

NO. 3AL GISHOLT with hardened steel ways.

26"x10' LIBBY with 7¼" hole through spindle. Power rapid traverse.

LATHES

20"x8' AMERICAN geared head, M.D.

24"x10' AMERICAN geared head, M.D.

30"x18' LODGE - SHIPLEY selective geared head.

36"x30' LODGE & SHIPLEY 18 speed geared head screw cutting engine lathe with two carriages, AC or DC.

No. 3. NILES - BEMENT - POND Axle Lathe.

30"x34' LEBLOND Boring Lathe geared heads, quick change gear.

42"x36' PUTNAM Geared Head, 25' between centers. Quick change gear box. AC or DC motor drive.

48"x30' BRIDGEFORD 9 Speed Geared Head, 20' between centers. Triple geared internal face plate drive. AC or DC motor.

48"x59' BRIDGEFORD Boring and Turning with 9 speed geared headstock, turning carriage with compound rest, AC or DC motor drive.

60"x48' NILES-BEMENT-POND heavy geared head, 35' centers, two carriages, M.D.

79" NILES-BEMENT-POND Locomotive Driving Wheel Lathe, Journal turning attachment.

42" PUTNAM Carwheel Lathe, M.D.

MILLERS

NO. 2B and 3B MILWAUKEE Plain, double overarm.

NOS. 2 and 3 CINCINNATI High Power, Vertical.

NO. 4 CINCINNATI High Power Plain. Power rapid traverse, table 16½"x64". Single pulley, belt drive or AC or DC.

NO. 4 CINCINNATI High Power Vertical. Power rapid traverse. Table 16½"x64". Single pulley belt drive.

NO. 5 CINCINNATI Plain, rectangular overarm.

24"x24"x12' INGERSOLL Horizontal Spindle Slab Miller with adjustable rail.

24"x24"x12' INGERSOLL Planer Type milling machine with one head on adjustable rail and two side heads.

42"x26"x12' INGERSOLL Planer Type milling machine with two heads on adjustable rail and two side heads AC, DC.

PLANERS

24"x24"x60" PUTNAM, M.D.

30"x30"x10' CINCINNATI, four heads, AC or DC motor drive.

38"x38"x14' OHIO Heavy with two heads on rail and one side head. 230 Volt DC reversing type planer motor and control.

48"x48"x15' NILES - BEMENT - POND Heavy with two heads on rail and two side heads. 230 Volt DC reversing type planer motor and control.

48"x48"x24' NILES - BEMENT - POND Heavy with two heads on rail and two side heads. 230 Volt DC reversing type planer motor and control.

48"x48"x32' G. A. GRAY Spiral Drive with two heads on rail and two side heads. 230 Volt DC reversing type planer motor and control.

72"x72"x15' N-B-P, 4 heads, double deck, 230 V., DC.

72" x 60" x 30' HAMILTON, 2 heads, operating condition as inspected F.O.B. CARS ALABAMA.

SLOTTERS

6" & 10" PRATT & WHITNEY vertical Shaper with rotary table, power feeds, tilting ram, AC or DC.

16" SPRINGFIELD Shaper, M.D.

15" NEWTON Crank slotter, 30" circular table, AC or DC.

15" NILES-BEMENT-POND, 30" circular table, AC or DC motor drive through gear box.

18" DILL Slotter, 34" rotary table.

21" N-B-P Slotter, 44" Rotary table.

MISCELLANEOUS

30' NO. 3 HILLES JONES Plate Edge Planer.

30'x⅞" NILES-BEMENT-POND Plate Bending Rolls, pyramid type.

1½" ACME Class "A" Bolt Cutter.

4" BAKER Automatic Tapper.

ENGINEERED Machine Tool REBUILDING

SIMMONS MACHINE TOOL CORPORATION

Main Office & Plant: 1600 N. Broadway, Albany 1, N. Y.

New York Office: 50 E. 42nd Street

OVERHEAD CRANES

200-Ton Alliance 100' Span
175-Ton Morgan 54' Span
150-Ton Whiting 30' Span
80-Ton "American" 40'6" Span
75-Ton Alliance 37' Span
75-Ton Alliance 78' Span
50-Ton Cleveland 71'10½" Span
50-Ton Shaw 69'10" Span
40-Ton Alliance 82' Span
35-Ton Northern 22' Span
30-Ton Case 41' Span
30-Ton Morgan 30' Span
30-Ton Morgan 77' Span
30-Ton Niles 53'9" Span
30-Ton P&H 80' Span
30-Ton Reading 56' Span
25-Ton Bedford 50' Span
25-Ton Cleveland 106' Span
25-Ton P&H 70' Span
25-Ton Whiting 106' Span
25-Ton Whiting 82' Span
25-Ton Whiting 56' Span
20-Ton Alliance 77' Span
20-Ton Cleveland 65' Span
20-Ton Morgan 77' Span
20-Ton Northern 60' Span
20-Ton P&H 39'6" Span
20-Ton P&H 51'4" Span
20-Ton Shaw 76'4" Span
20-Ton Shepard Niles 49'6" Span
20-Ton Shaw 76'4" Span
15-Ton Alliance 50' Span
15-Ton Alliance 35' Span
15-Ton Cleveland 55'6" Span
15-Ton Cleveland 35' Span
15-Ton Morgan 77' Span
15-Ton Niles 32' Span
15-Ton Northern 53' Span
15-Ton Shaw 82' Span
15-Ton Shaw 77' Span
15-Ton Toledo 82' Span
15-Ton Whiting 74'8½" Span
15-Ton Whiting 71'10½" Span
12-Ton Morgan 56' Span
10-Ton Alliance 58'9" Span
10-Ton Alliance 71'10" Span
10-Ton "American" 27' Span
10-Ton Cleveland 38' Span
10-Ton Cleveland 50' Span
10-Ton Emsco 50' Span
10-Ton Lane 50' Span
10-Ton Morgan 39'5" Span
10-Ton P&H 57' Span
10-Ton P&H 78' Span
10-Ton P&H 87'6" Span
10-Ton Northern 34' Span
10-Ton P&H 48'10½" Span
10-Ton P&H 60' Span
10-Ton P&H 80' Span
10-Ton Shaw 68' Span
10-Ton Shaw 58' Span
10-Ton Shaw 88' Span
10-Ton Northern 71'10½" Span
7½-Ton Erie 70' Span
7½-Ton P&H 30'6" Span
7½-Ton Scullin 71'10½" Span
7½-Ton Shepard 36' Span
6-Ton Shaw 23' Span
5-Ton "American" 10' Span
5-Ton Champion 37'6" Span
5-Ton Euclid
5-Ton Milwaukee 39'8" Span
5-Ton Milwaukee 66'9" Span
5-Ton Milwaukee 70' Span
5-Ton Northern 49'6" Span
5-Ton P&H 45' Span
5-Ton Shaw-Box 25' Span
5-Ton Shepard 40' Span
5-Ton Toledo 96' Span
5-Ton Whiting 80' Span
3-Ton P&H 46'4" Span
3-Ton Shaw 33' Span
3-Ton Whiting 57'3" Span
2-Ton Detroit 28' Span
2-Ton P&H 46'4" Span
2-Ton Shepard-Niles 18' & 14'
1½-Ton Cleveland 25' Span
1½-Ton P&H 34' Span
1-Ton Curtis 24' Span

Take advantage of the ECONOMY service by telephoning to us collect, which will enable us to discuss your requirements and present our suggestions.

In addition to overhead cranes we can supply all types of shovels, cranes, draglines, tractors, for practically everything in the construction equipment field. May we have your inquiries?

ECONOMY CO., Inc.

49 Vanderbilt Avenue — New York 17, N. Y.

Telephones: MUrray Hill 4-2294, 4-2893, 4-2295, 4-2844, 4-2296, 4-8292

CIMSCO Rebuilt Machine Tools

LATHES

36"x30' Lodge & Shipley Grd. Hd. 2 Carriages.
36"x36' American Grd. Hd. 2 Carriages.
42"x16' American Grd. Hd. Taper.
24"x14' American Grd. Hd. 12 Speed.
27"x16' Lodge & Shipley Grd. Hd. S.P.D.

GEAR CUTTERS AND HOBBERS

No. 3 Adams Farwell Gear Hobbing Machine.
No. 6—60" Brown & Sharpe Gear Cutter.
6" Bilgram Bevel Gear Generator.
18" Gleason Bevel Gear Generator.
No. 1 Schuchart & Schutte Gear Hobber, 3 S.C.D.
No. 1 Adams Farwell Gear Hobber, B.D.

GRINDERS

Lees-Bradner Gear Grinder.
10"x96" Landis Plain Self Contained.
10"x72" Norton Type C, Hydraulic A.C. Motor.

MILLING MACHINES

No. 3 Cincinnati H.P. Vertical, S.P.D.
No. 4 Cincinnati Dial Type Medium Speed, A.C., M.D.

RADIAL DRILLS

6' American Triple Purpose, M.D.
6' Cincinnati-Bickford, M.D.
7' Cincinnati-Bickford, M.D.

MISCELLANEOUS

24" & 36" Bullard New Era Vertical Turret Lathe.
61" Bullard Maximill, A.C., M.D., 2 Heads.
56"x56"x36' Cincinnati Planer, 4 Heads.
36"x36"x20' Cincinnati Planer, 2 Heads.
24"x24"x10' Powell Planer, 2 Hds. M.D.
42" Bullard, 2 Heads, Self-contained type.

If machines you need are not listed above, send us your inquiry. We have a very large stock.

Cincinnati Machinery & Supply Co.
217 E. Second St., Cincinnati, Ohio

FACTORY MANAGER, OR CHIEF INDUSTRIAL ENGINEER

Graduate, cooperative mechanical engineering course. Age 44. 28 years experience includes operating supervision, material and production control, purchasing, time study and standard control of labor costs, methods, work simplification and cost reduction programs, maintenance cost control, and tool usage control. Manufacturing background includes locomotive repair, cast iron pipe, printing and lithographing, harness and clothing, hardware, slide fasteners, electronic and powdered metal parts. Production tooling, equipment, and techniques for strip steel and brass, wire, and small cast parts production, assembly and finish. Successful Labor Relation Administration. Box No. 361, MACHINERY, 148 Lafayette Street, New York 13, N. Y.

MACHINERY FOR SALE

One 24" x 6' Ohio Planer, Motorized 3/60/220. Very reasonable.

One No. 48-W. Bridgeport Abrasive Cut-Off Saw, including Rotary Attachment to Rotate Stock During Cutting Operation, 3/60/220. Manufacturer's Serial No. A-461.

One 12" x 48" Norton Type "C" Universal Multi-Purpose Grinder, complete with Internal Grinding Spindle and Quills 3/60/220. Manufacturer's Serial No. L-1288.

Two General Electric CR-7052A1 Automatic Compensators, both 440 Volts, 60 Cycle, 3 Phase, one 15 HP size, one 20 HP size.

26—2-15/16 Diameter Plain Rigid Pillow Blocks.

VISIONEERING CO., INC.
4700 Prospect Ave.
CLEVELAND 1, OHIO

PATENTS FOR SALE

New perfected movements on single action one operation drawing and trimming dies for general deep or regular cylindrical, rectangular irregular large or small shape shell articles with or without a flange. Also new punch holder for interchanging different sizes of punch drawing and trimming sleeve parts to cut down the cost of building the dies. Eliminates the second trimming die, plus power press, plus operator and is a great time saver. On sale outright or shop-right with service. Burnett Menkin, 62 West 11th Street, New York 11, N. Y.

GEAR DESIGN

Spur—Helical—Bevel—Worm
EXPERTS IN FINE-PITCH
Application and Processing
EMPIRE ENGINEERS
515 Mercantile Bldg., Rochester 4, N. Y.

Manufacturers' Representative

twenty years' machine tool sales experience, desires additional lines of machine tools and cutting tools for Western Michigan. Write Box No. 359, MACHINERY, 148 Lafayette St., New York 13, N. Y.

NORTON 24" x 240" PLAIN GRINDER MOTOR DRIVEN

MOREY MACHINERY CO., INC.
410 Broome St., N. Y. 13, N. Y.

INDUSTRIAL ENGINEER

Wanted for permanent position with old established and successful company building high grade machinery.

For capable engineer experienced in successful operation of production and cost controls and other phases of industrial engineering, this offers unusual opportunities.

Plant is modern and located in attractive residential section of upper New York State.

Applications will be treated as confidential and should give particulars as to experience, age, references, etc.

Address Box No. 363, MACHINERY, 148 Lafayette St., New York 13, N. Y.

ALLEN

FLAT HEAD CAP SCREWS

Check these advantages with your *flush fastening* requirements, *and call your local Allen* Distributor:

(1) Flush top surface with no gap between screw head and surrounding metal. (2) Extreme rigidity of grip, because angle of head helps lock screw in place by drawing down on a conical surface. (3) Firmer hold on thin plates of metal, by more binding surface under the head than in fillister type or cheese-head screws. (4) Shallower countersink — less weakening of metal — when used for fastening a relatively thin plate. (5) Positive engagement of hex key transmits power for tightest of set-ups without slipping, reaming or side play. (6) Maximum strength of screw itself assured by *"pressur-forming"* of special-analysis ALLENOY steel. Threaded to a high Class 3 fit. (7) Speed in assembly provided for by use of Allen hand drivers.

THE ALLEN MFG. CO.
Hartford 1, Conn.

CLASSIFIED AND RE-SALE SECTION

FOR SALE

One **HEVI DUTY** Electric Company type HD24726 mesh conveyor electric furnace 60 K.W., 230 volts, 10' loading area, 13' cooling zone, variable conveyor speeds, Brown automatic controls and recorders, maximum safe temperature 1400°F. This furnace only used three months. **Box 334, MACHINERY, 148 Lafayette St., New York 13, N. Y.**

MANUFACTURERS' AGENTS

Wanted by an old, well established company manufacturing Milling Cutters, Reamers, and Special Metal Cutting Tools. To sell on a commission basis in St. Louis, San Francisco, Minneapolis, Baltimore and New Orleans territories. Agents who are now selling allied, but non-competitive lines. **Box No. 150, MACHINERY, 148 Lafayette Street, New York 13, N. Y.**

WANTED

SALES ENGINEER for Metropolitan New York; technical graduate preferred; age 30-40 years, power transmission material; salary and bonus. **Box No. 365, MACHINERY, 148 Lafayette Street, New York 13, N. Y.**

CANCER KILLS 175,000 EVERY YEAR

Your contribution will help fight Cancer!

Place your gift in an envelope, address it simply "CANCER" and drop it into any mail-box in the U. S. Your local postmaster will see that it reaches

THE AMERICAN CANCER SOCIETY

AVAILABLE — Sales Engineer

Hydraulic Presses (Self Contained). Fifteen years experience—engineering, service, sales. Age 40. Middle west preferred. Will also consider position as sales representative. **Box No. 362, MACHINERY, 148 Lafayette St., New York 13, N. Y.**

EXECUTIVE AVAILABLE

DEVELOPMENT, DESIGN AND TOOL ENGINEER, SHOP SUPT.

25 years practical experience. Ability to handle product from design through tooling and manufacture. Experienced in purchase of machinery and plant layout. Successful handling personnel. **Box 357, MACHINERY, 148 Lafayette Street, New York 13, N. Y.**

MANUFACTURER'S AGENT, engineering background, now selling outstanding machine component to diversified industrial fields. Will consider additional lines for California. Large following of progressive engineers constantly contacted. Proper representation guaranteed. Give full details. **Box No. 343, MACHINERY, 148 Lafayette Street, New York 13, N. Y.**

FOR SALE

Completely equipped manufacturing plant, building and equipment. Doing good business in large business city in Florida. **Box No. 353, MACHINERY, 148 Lafayette Street, New York 13, N. Y.**

MACHINE ENGRAVER — FIRST CLASS

Experienced with dies such as used on radio escutcheons, dashboards, etc.; able to 1. Take charge of new dept. 2. Or work under supervision. Old established plant: N. Y. area. Permanent position. Write full experience, salary expected. ETCHED PRODUCTS CORP., 39-01 Queens Boulevard, L. I. City, N. Y.

MACHINE BUILDING AND ENGINEERING ORGANIZATION is interested in acting as sales and/or installation engineers for proven industrial mechanical devices in Wilmington, Delaware. area. Established and incorporated company with equipment and personnel qualified to handle entire job. **Box No. 358, MACHINERY, 148 Lafayette Street, New York 13, N. Y.**

PRODUCT INDEX

For addresses of manufacturers listed, consult advertisements in this and previous issue. Index Pages 447-448

ABRASIVE CLOTH AND PAPER
Carborundum Co.
Walls Sales Corp.

ABRASIVE DISCS
See Discs, Abrasive.

ABRASIVES, POLISHING
Carborundum Co.
Norton Co.

ACCUMULATORS, Hydraulic
Baldwin-Southwark Corp.
Bethlehem Steel Co.
Elmes Engineering Works
Farquhar, A. B., Co.
Farrel-Birmingham Co., Inc.
Hydropress Co., Inc.
Lake Erie Engineering Corp.
Morgan Engineering Co.
Watson-Stillman Co.

AIR HOISTS—See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, etc.

ALLOYS FOR DIES
National Lead Co.

ALLOY-STEELS
Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Carnegie-Illinois Steel Corp., (U. S. Steel Corp. Div.)
Carpenter Steel Co.
Firth-Sterling Steel Co.
Frasse, Peter A., & Co., Inc.
Republic Steel Corp., (Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.
Vanadium Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.

ALLOYS, ALUMINUM
Aluminum Co. of America

ALLOYS, MAGNESIUM
Dow Chemical Co.

ALLOYS, NON-FERROUS
American Brass Co.

ARBOR PRESSES
See Presses, Arbor.

ARBORS AND MANDRELS
Anker-Holth Mfg. Co.
Brown & Sharpe Mfg. Co.
Cleveland Twist Drill Co.
Danly Machine Specialties, Inc.
Hannifin Mfg. Co.
Jacobs Mfg. Co.
Kempsmith Mch. Co.
Morse Twist Drill & Mch. Co.
National Tool Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Scully-Jones & Co.
Standard Tool Co.
Union Twist Drill Co.

BABBITT
Besly, Chas. H., & Co.
Bunting Brass & Bronze Co.
Cramp Brass & Iron Fdrs. Div.
Johnson Bronze Co.
Ryerson, Joseph T., & Son, Inc.

BALANCING EQUIPMENT
Anderson Bros. Mfg. Co.
Gisholt Machine Co.
Ideal Industries, Inc.
Norton Co.
Pope Machinery Corp.
Sundstrand Mch. Tool Co.
Taylor Mfg. Co.

BALLS, Brass, Steel, Etc.
Gwilliam Co.
S K F Industries, Inc.

BARS, Boring
See Boring Bars.

Phosphor Bronze
Bunting Brass & Bronze Co.
Johnson Bronze Co.

Steel
Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Carpenter Steel Co.
Firth-Sterling Steel Co.
Frasse, Peter A., & Co., Inc.
Jones & Laughlin Steel Corp.
Republic Steel Corp., (Union Drawn Steel Div.)
Rustless Iron & Steel Div. American Rolling Mills Co.
Ryerson, Joseph T., & Son, Inc.
Timken Roller Bearing Co.
Wheelock, Lovejoy & Co.

BASES, Machinery, Welded
Mahon, R. C., Co.

BASKETS AND TRAYS
Ludlow-Saylor Wire Co.

BEARINGS

Babbitt
Bunting Brass & Bronze Co.
Hill Acme Co.
Johnson Bronze Co.

Ball
Atlantic Gear Works, Inc.
Ball & Roller Bearing Co.
Bantam Bearings Div.
Bearings Co. of America
Boston Gear Works, Inc.
Equitable Bearing Co., Inc.
Fafnir Bearing Co.
Federal Bearings Co., Inc.
Gwilliam Co.
Kaydon Engineering Corp.
McGill Manufacturing Co.
Nice Ball Bearing Co.
Norma-Hoffmann Bearings Corp.
Schatz Mfg. Co.
S K F Industries, Inc.
Torrington Co.

Bronze and Special Alloy
Amoco Metal, Inc.
Besly, Chas. H., & Co.
Bunting Brass & Bronze Co.
Haynes Stellite Co.
Johnson Bronze Co.

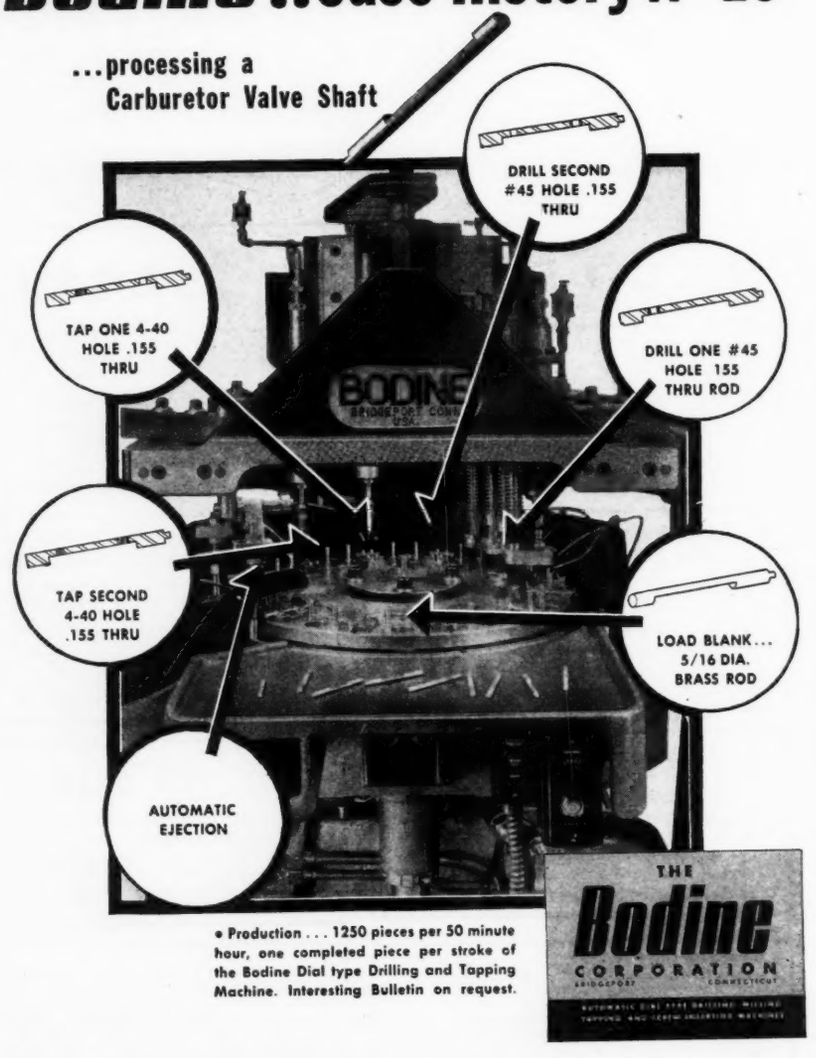
Lineshaft
Fafnir Bearing Co.
S K F Industries, Inc.
Standard Pressed Steel Co.

Needle
Bantam Bearings Div.
Norma-Hoffmann Bearings Corp.
Orange Roller Bearing Co., Inc.
Torrington Co.

Roller
Bantam Bearings Div.
Equitable Bearing Co., Inc.
Fafnir Bearing Co.
Gwilliam Co.
Kaydon Engineering Corp.
McGill Manufacturing Co.
Norma-Hoffmann Bearings Corp.
Orange Roller Bearing Co., Inc.
Roller Bearing Co. of America
Rollway Bearing Co., Inc.
S K F Industries, Inc.
Timken Roller Bearing Co.

Self-Lubricating (Oilless)
Arguto Oilless Bearing Co.
Bunting Brass & Bronze Co.
Johnson Bronze Co.
Raybestos-Manhattan, Inc., Manhattan-Rubber Div.

Spherical
Heim Co.


Bodine..Case History No 16
...processing a Carburetor Valve Shaft
DRILL SECOND #45 HOLE .155 THRU
TAP ONE 4-40 HOLE .155 THRU
DRILL ONE #45 HOLE 155 THRU ROD
TAP SECOND 4-40 HOLE .155 THRU
LOAD BLANK... 5/16 DIA. BRASS ROD
AUTOMATIC EJECTION
THE Bodine CORPORATION
BRIDGEPORT CONNECTICUT

• Production . . . 1250 pieces per 50 minute hour, one completed piece per stroke of the Bodine Dial type Drilling and Tapping Machine. Interesting Bulletin on request.

Tapered Roller

Bantam Bearings Div.
Kaydon Engineering Corp.
Raybestos-Manhattan, Inc.
Manhattan-Rubber Div.
Orange Roller Bearing Co., Inc.
Timken Roller Bearing Co.

Thrust

Atlantic Gear Works, Inc.
Ball & Roller Bearing Co.
Bantam Bearings Div.
Bearings Co. of America
Boston Gear Works, Inc.
Bunting Brass & Bronze Co.
Fafnir Bearing Co.
General Electric Co.
Gwilliam Co.
Kaydon Engineering Corp.
McGill Manufacturing Co.
Norma-Hoffmann Bearings Corp.
Orange Roller Bearing Co., Inc.
Timken Roller Bearing Co.

BELT FASTENERS, Metal, Leather, Etc.

Bristol Co.
Raybestos-Manhattan, Inc.,
Manhattan-Rubber Div.

BELT SHIFTERS

LeBlond, R. K., Mch. Tool Co.
Standard Pressed Steel Co.

BELTING TRANSMISSION

Manheim Mfg. & Belting Co.
Raybestos-Manhattan, Inc.,
Manhattan-Rubber Div.

BENCHES, Work, and Bench Legs

Baumbach, E. A., Mfg. Co.
Hill Acme Co.
Standard Pressed Steel Co.

BENDING MACHINES

Angle Iron

Consolidated Mch. Tool Corp.
Hannifin Mfg. Co.

Hydraulic

Bethlehem Steel Co.
Buffalo Forge Co.
Farquhar, A. B., Co.
Hannifin Mfg. Co.
Hydraulic Press Mfg. Co.
Lake Erie Engineering Corp.
Morgan Engineering Co.
Watson-Stillman Co.

Pipe

Buffalo Forge Co.
Farquhar, A. B., Co.
Hydraulic Press Mfg. Co.
Watson-Stillman Co.

BLAST CLEANING EQUIPMENT

Pangborn Corp.
Production Machine Co.
Walls Sales Corp.

BLOWERS

Buffalo Forge Co.
Ideal Industries, Inc.
DeLaval Steam Turbine Co.
Ingersoll-Rand Co.
Westinghouse Electric Corp.

BOILER TUBES

Ajax Manufacturing Co.
Bethlehem Steel Co.
Jones & Laughlin Steel Corp.
National Tube Co.
(U. S. Steel Corp., Div.)
Ryerson, Joseph T., & Son, Inc.
Timken Roller Bearing Co.

BOLT AND NUT MACHINERY

Ajax Manufacturing Co.
Denison Engineering Co.
Hill Acme Co.
Landis Mch. Co.
Modern Tool Works
National Machinery Co.
New Britain-Gridley Mch. Div.,
New Britain Machine Co.
Oster Manufacturing Co.

BOLTS AND NUTS

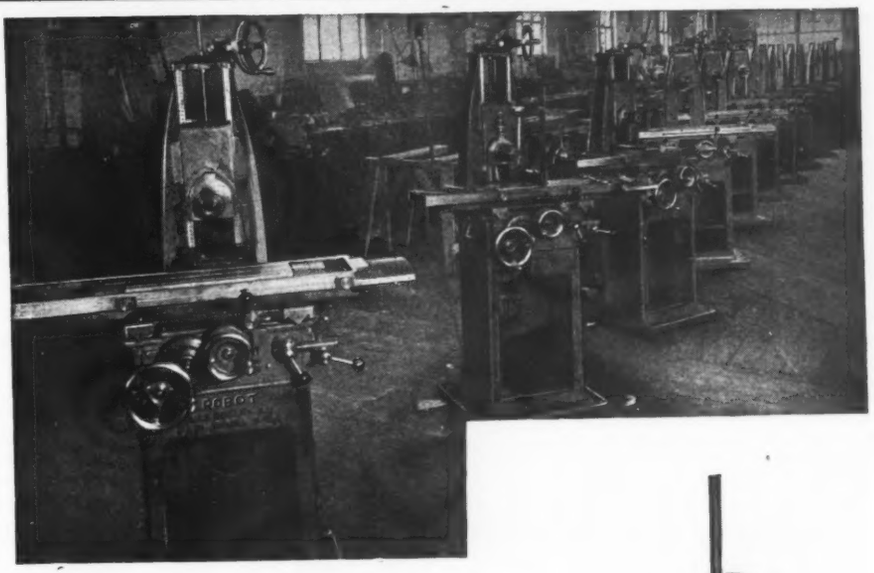
Aluminum Co. of America
Bethlehem Steel Co.
Elastic Stop Nut Corp. of America
National Acme Co.
Pawtucket Mfg. Co.
Republic Steel Corp.,
(Union Drawn Steel Div.)

BOOKS, Technical

Industrial Press
Lincoln Electric Co.

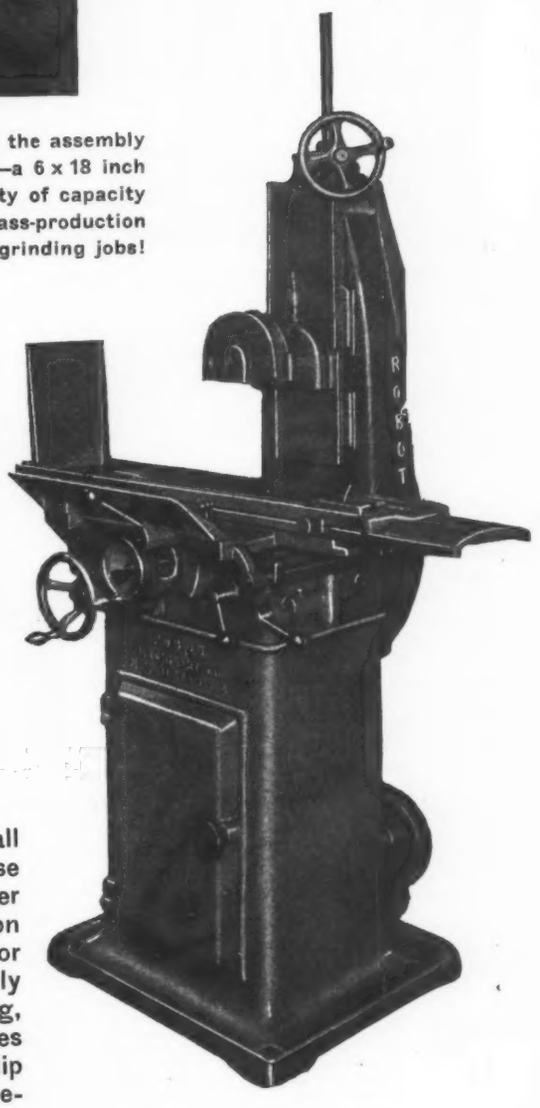
BORING AND DRILLING MACHINES, Vertical

Baker Brothers, Inc.
Barnes Drill Co.
Barnes, W. F., & John, Co.
Bullard Company
Consolidated Mch. Tool Corp.
Cosa Corp.
Foote-Burt Co.
Gorton, George, Mch. Co.
Ingersoll Milling Mch. Co.
Jones Machine Tool Wks., Inc.
Moline Tool Co.
National Acme Co.
National Automatic Tool Co.



Above: Robot Surface Grinders on the assembly line. We make this one size only—a 6 x 18 inch precision grinder that affords plenty of capacity for a wide variety of jobs. Our mass-production economies mean economy on your grinding jobs!

THE ROBOT PRECISION SURFACE GRINDER



Speed up the grinding of all types of small parts! Release larger machines for larger work! The Robot Precision Surface Grinder is ideal for production jobs . . . and quickly set up for odd-lot grinding, too. Outstanding features of construction include: Slip clutch reverse drive that reverses table smoothly at any definite point . . . Spindle and bronze bearing ground to tolerances within .0001" . . . Long table ways for greater steadiness and uniform accuracy. Write for further details, prices and guaranteed delivery dates.

ROBOT MACHINERY COMPANY
326 Ten Eyck St. BROOKLYN, N. Y.
EVERGREEN 7-4084-5-6

Pedrick Tool & Mch. Co.
Rogers Machine Works, Inc.
Sellers, Wm., & Co., Inc.

BORING AND TURNING MILLS, Vertical

Bullard Company
Cincinnati Planer Co.
Cosa Corp.
Jones Machine Tool Works, Inc.
Rogers Machine Works, Inc.
Sellers, Wm., & Co., Inc.

BORING BARS

Armstrong Bros. Tool Co.
Bullard Company
Carboloy Co., Inc.
Ex-Cell-O Corp.
Firth-Sterling Steel Co.
Gairing Tool Co.
Gisholt Machine Co.
McCrosky Tool Corp.
Ready Tool Co.
Scully-Jones & Co.
Warner & Swasey Co.
Williams, J. H., & Co.

BORING, DRILLING AND MILLING MACHINES, Horizontal

Barnes, W. F., & John, Co.
Cross Co.
Firth-Sterling Steel Co.
Giddings & Lewis Mch. Tool Co.
Ingersoll Milling Mch. Co.
Jones Machine Tool Wks., Inc.
Lucas Mch. Tool Co.
Moline Tool Co.
National Automatic Tool Co.
Ohio Machine Tool Co.
Sellers, Wm., & Co., Inc.
Universal Boring Machine Co.

BORING HEADS

Criterion Machine Works
Ex-Cell-O Corp.
Gairing Tool Co.
McCrosky Tool Corp.

BORING HEADS, Offset

Gairing Tool Co.

BORING MACHINES, Diamond and Carbide Tool

Ex-Cell-O Corp.
Heald Machine Co.
National Automatic Tool Co.
Stokerunit Corp.

BORING MACHINES, Jig

Cincinnati Bickford Tool Co.
Fosdick Machine Tool Co.
Kearney & Trecker Products Corp.
Machinery Mfg. Co.
Moore Special Tool Co., Inc.
Pratt & Whitney Co.
Reed-Prentice Corp.
Triplex Machine Tool Corp.

BORING TOOLS

Armstrong Brothers Tool Co.
Carboloy Co., Inc.
Ex-Cell-O Corp.
Firth-Sterling Steel Co.
Gairing Tool Co.
Gisholt Mch. Co.
Haynes Stellite Co.
Jones & Lamson Mch. Co.
Kennametal, Inc.
McCrosky Tool Corp.
Morse Twist Drill & Mch. Co.
Ready Tool Co.
Scully-Jones & Co.
Slocomb, J. T., Co.
Super Tool Co.
Union Twist Drill Co.
Warner & Swasey Co.
Williams, J. H., & Co.

BRAKES, Press and Bending

Bliss, E. W., Co.
Cincinnati Shaper Co.
O'Neil-Irwin Mfg. Co.
Peck, Stow & Wilcox Co.
Steelweld Mchry. Div. of Cleveland Crane & Engrg. Co.
Verson Allsteel Press Co.
Watson-Stillman Co.

BROACHES

American Broach & Mch. Co.
Carboloy Co., Inc.
Colonial Broach Co.
Detroit Broach Co.
Ex-Cell-O Corp.
Illinois Tool Wks.
Lapointe Machine Tool Co.
National Broach & Mch. Co.
Super Tool Co.

BROACHING MACHINES

American Broach & Mch. Co.
Cincinnati Milling Mch. Co.
Colonial Broach Co.
Consolidated Mch. Tool Corp.
Foote-Burt Co.
Lapointe Machine Tool Co.
National Broach & Mch. Co.

BRONZE

American Brass Co.
Ampco Metal, Inc.
Bunting Brass & Bronze Co.
Cramp Brass & Iron Foundries Div.
Delta Manufacturing Co.
Jefferson Machine Tool Co.
Johnson Bronze Co.
Shook Bronze Co.

BUFFERS

Bridgeport Safety Emery Wheel Co., Inc.
Delta Manufacturing Co.
Gardner Machine Co.
Production Machine Co.
Rotor Tool Co.

BULLDOZERS

Ajax Manufacturing Co.
Baldwin-Southwark Corp.
Hannifin Mfg. Co.
Lake Erie Engineering Corp.
Watson-Stillman Co.

BURNISHING MACHINERY

Baird Machine Co.

BUSHINGS, Brass, Bronze, Etc.

Ampco Metal, Inc.
Boston Gear Works, Inc.
Bunting Brass & Bronze Co.
Haynes Stellite Co.
Johnson Bronze Co.

Hardened

Baumbach, E. A., Mfg. Co.
Danly Machine Specialties, Inc.
Leland-Gifford Co.
U. S. Steel Co., Inc.

Jig

Ampco Metal, Inc.
Colonial Broach Co.
Ex-Cell-O Corp.
Universal Engineering Co.

CABINETS, Tool

Armstrong Brothers Tool Co.

CALIPERS

Brown & Sharpe Mfg. Co.
Scherr, George, Co., Inc.
Starrett, L. S., Co.

CAM CUTTING MACHINES

Frew Machine Co.
Pratt & Whitney Co.

CAM MILLING AND GRINDING MACHINES

Rowbottom Machine Co.

CAMS

Hartford Special Mchry. Co.
Kux Machine Co.
Rowbottom Machine Co.
Vinco Corporation

CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN

Allegheny Ludlum Steel Corp.
Carboloy Co., Inc.
Firth-Sterling Steel Co.
Kennametal, Inc.
Metal Carbides Corp.
Super Tool Co.
Vanadium Alloys Steel Co.

CASE-HARDENING

Pittsburgh Gear & Machine Co.
Williams, J. H., & Co.

CASE-HARDENING FURNACES

See Furnaces, Heat Treating.

CASTINGS

Aluminum, Brass, Bronze, Magnesium, Etc.

Aluminum Co. of America
Ampco Metal, Inc.
Bethlehem Steel Co.
(Brass and Bronze only)
Bunting Brass & Bronze Co.

HEAT TREAT SMALL PARTS
In Your Own Plant

ESSENTIAL FOR TOOL AND DIE SHOPS

You save time and money heat treating small tools and dies in a Cooley Electric Furnace. Uniform temperatures are maintained throughout the furnace chamber to assure even heating of parts. The heating elements are embedded in refractory materials, protecting against atmospheric attack. They are easily replaceable.

ECONOMICAL TO OPERATE

To hold 1600° F. in the MH-3 furnace requires less than 2 kw. At power rate of 2c per kw.-hr., operating cost is under 4c per hour. The MH-4 furnace requires less than 2.5 kw. or under 5c per hour at the same rate. Cooley Furnaces are easily installed—ready for immediate service by connecting power lines to two terminals. Quiet in operation—no fumes or odors—no ventilating necessary—they can be located at any convenient place in the shop.

More Profitable Reasons for Using Cooley Furnaces

1—Hardening, drawing and tempering small batches in large furnaces is uneconomical.

2—Small parts can be normalized and annealed quickly and easily.

3—Convenient for pre-heating prior to high-speed hardening.

4—Always available to handle emergency repair work without delay.

5—Use as a pilot furnace to predetermine techniques for production heat treating.

TWO NEW OPTIONAL FEATURES AVAILABLE

1. Vertical Lift Door—Counter weighted for ease of operation—conserves heat where door need not be fully opened to enter or remove work. Supplied in place of standard hinged hearth door at $20.00 additional to regular furnace prices shown below.

2. Heavy Gauge Steel Stand—For ease of installation and operation—locates furnace at most convenient operating height and provides additional working and storage space. Add $35.00 to regular furnace prices shown below.

AVAILABLE IN TWO SIZES

Type	Chamber Capacity	Amps 115 V	Watts	Amps 230 V	Price
MH-3	8″W 6″H 14″L	29.6	3400	14.8	$146.00*
MH-4	10″W 6″H 18″L	.....	4800	20.9	$222.50*

*Includes Hearth Plate

MAX. SAFE TEMPERATURE—Continuous operation, 1750° F.; Intermittent operation, 1850° F.
AUTOMATIC CONTROL—Indicating Controlling Pyrometer—Thermo-couple and lead wire—approximately $150.00.

NO SALESMEN WILL CALL

Ask for free information and ordering instructions so you can make your own decision and determine your own requirements. Write for Bulletin No. 50 today—no obligation.

COOLEY ELECTRIC MANUFACTURING CORP.
44 South Shelby Street Indianapolis 7, Indiana
Export Department, 1111 S. Ferry Building, New York 4, New York

Cramp Brass & Iron Foundries Div.
Permold Co.
Superior Bearing Bronze Co., Inc. (Magnesium)

Die

Aluminum Co. of America
American Brass Co.
Madison-Kipp Corporation
Veeder-Root, Inc.

Gray Iron

Bethlehem Steel Co.
Brown & Sharpe Mfg. Co.
Union Mfg. Co.

Steel, Alloys, Etc.

Allegheny Ludlum Steel Corp.
American Brake Shoe Co.
Bethlehem Steel Co.
Birdsboro Steel Fdry. & Mch. Co.
Cramp Brass & Iron Foundries Div.
Lebanon Steel Foundry

CEMENT, Disc Grinding Wheel

Besly, Chas. H., & Co.
Carborundum Co.
Gardner Machine Co.
Hendey Machine Co.
Walls Sales Corp.

CENTERING MACHINES

Consolidated Mch. Tool Corp.
Cross Co.
Hanson-Whitney Machine Co.
Jones & Lamson Mch. Co.
Pratt & Whitney Co.

CENTERS

Lathe

Carboloy Co., Inc.
Firth-Sterling Steel Co.
Ideal Industries, Inc.
Kennametal, Inc.
Morse Twist Drill & Mch. Co.
Scully-Jones & Co.
Standard Tool Co.
Super Tool Co.

Planer and Miller

Cincinnati Planer Co.

CHAIN DRIVES

Morse Chain Co.

CHAINS, Power Transmission and Conveyor

Boston Gear Works, Inc.
Philadelphia Gear Works

CHAMFERING MACHINES, Gear Tooth

Bilgram Gear & Mch. Works
Consolidated Mch. Tool Corp.
Cross Co.
Grant Mfg. & Mch. Co.
Lipe-Rollway Corp.

CHISELS AND CHISEL BLANKS

Bethlehem Steel Co.

CHUCKING MACHINES

Baird Machine Co.
Bardons & Oliver, Inc.
Bliss, E. W., Co.
Bullard Company
Cleveland Automatic Machine Co.
Gisholt Machine Co.
Goss & DeLeeuw Mch. Co.
Heald Machine Co.
Jones & Lamson Machine Co.
National Acme Co.
New Britain-Gridley Mch. Div.
Potter & Johnston Mch. Co.
Sundstrand Mch. Tool Co.
Warner & Swasey Co.

Multiple Spindle

Goss & DeLeeuw Mch. Co.
National Acme Co.
New Britain-Gridley Mch. Div.

CHUCKS

Air Operated

Anker-Holth Mfg. Co.
Hannifin Mfg. Co.
Logansport Machine Co., Inc.
Skinner Chuck Co.
Union Mfg. Co.

Collet or Split

See Collets.

Diaphragm

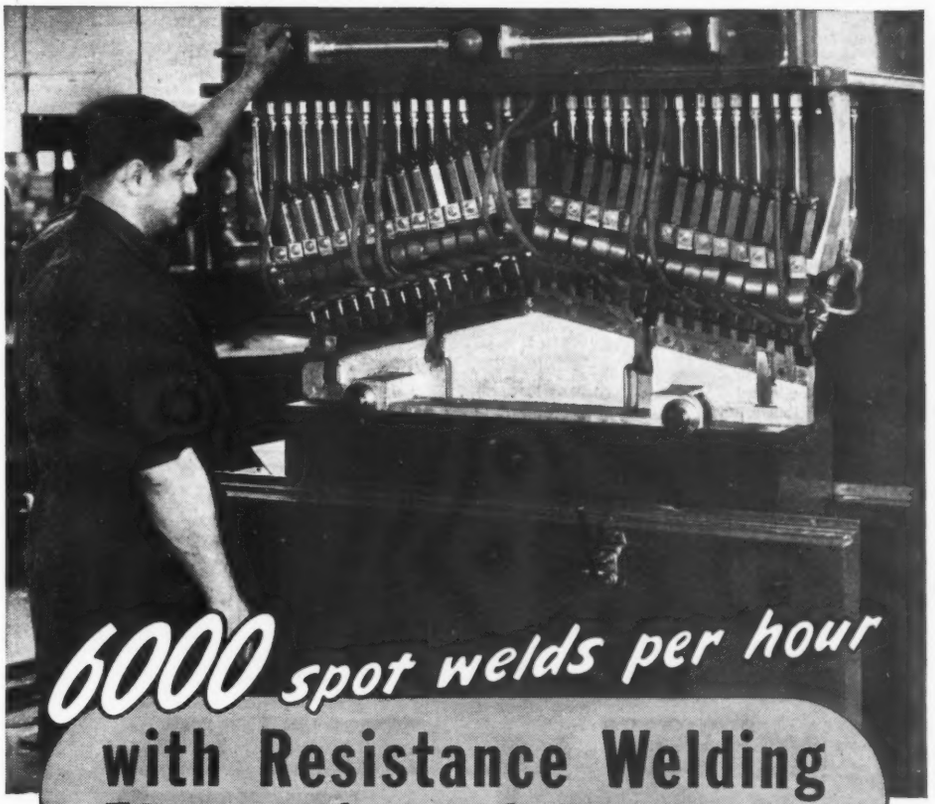
Van Norman Co.

Drill

Cleveland Twist Drill Co.
Ettco Tool Co.
Jacobs Mfg. Co.
McCrosky Tool Corp.
Modern Tool Works
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Procunier Safety Chuck Co.
Scully-Jones & Co.
Skinner Chuck Co.
Standard Tool Co.
Taylor Mfg. Co.
Union Mfg. Co.

Full Floating

Errington Mechanical Laboratory
Gisholt Mch. Co.
Scully-Jones & Co.



6000 spot welds per hour with Resistance Welding Electrodes of Ampcoloy

AMPCO
Resistance Welding Products include...

- spot-welding electrodes
- seam-welding wheels
- centrifugally-cast seam-welder bushings
- seam-welder shafts
- flash- and projection-welder dies
- extruded and drawn rounds
- plus many others

RW-4A

Controlled quality and uniformity eliminate costly production losses

This Hydromatic, spot-welding grille bars to a grille frame at the rate of some 100 assemblies per hour, demonstrates that the controlled quality and uniformity of Ampco spot-welding electrodes result in increased production and lower cost for you.

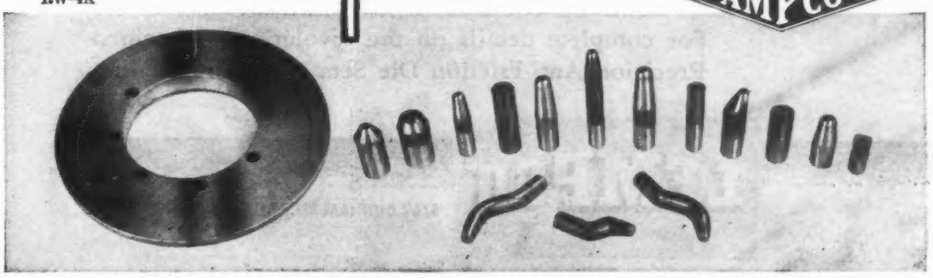
At Ampco, all resistance-welding products comply with RWMA specifications. Control of quality and uniformity — both absolutely necessary in this exacting field — are kept under close supervision of laboratory technicians throughout the entire production cycle.

You reduce your welding costs and increase your production when you specify Ampco's *uniform* welding electrodes. Complete details are given in Bulletin 68.

Write for your copy today.

Ampco Metal, Inc., Dept. M-5
Milwaukee 4, Wisconsin
Field offices located in Principal Cities

AMPCO



Lathe, Etc.
Anker-Holth Mfg. Co.
Bullard Company
Cushman Chuck Co.
Gisholt Mch. Co.
Jones & Lamson Mch. Co.
Rivett Lathe & Grinder, Inc.
Scherr, George, Co., Inc.
Skinner Chuck Co.
Union Mfg. Co.
Warner & Swasey Co.

Magnetic
Arter Grinding Machine Co.
Brown & Sharpe Mfg. Co.
Hanchett Mfg. Co.
Taft-Peirce Mfg. Co.
Walker, O. S., Co., Inc.

Quick Change and Safety
Errington Mechanical Laboratory
McCrosky Tool Corp.
Modern Tool Works
National Tool Co.
Procunier Safety Chuck Co.
Scully-Jones & Co.

Ring Wheel
Bridgeport Safety Emery Wheel Co., Inc.
Gardner Machine Co.

Tapping
Barber-Colman Co.
Errington Mechanical Laboratory
Greenfield Tap & Die Corp.
Jacobs Mfg. Co.
McCrosky Tool Corp.
Procunier Safety Chuck Co.
Scully-Jones & Co.
Skinner Chuck Co.

CIRCUIT BREAKERS
General Electric Co.
Westinghouse Electric Corp.

CLAMPS
Armstrong Brothers Tool Co.
Baumbach, E. A., Mfg. Co.
Besly, Chas. H., & Co.
Brown & Sharpe Mfg. Co.
Danly Machine Specialties, Inc.
Starrett, L. S., Co.
Williams, J. H., & Co.

CLEANERS, Chemical, for Metal
Bullard Co., Bullard-Dunn Process Div.
Oakite Products, Inc.

CLUTCHES
Barnes Drill Co.
Clearing Mch. Corp.
Farrel-Birmingham Co., Inc.
Foote Bros. Gear & Machine Corp.
Hilliard Corp.
Johnson, Carlyle, Machine Co.
Lipe-Rollway Corp.
Morse Chain Co.
Rockford Clutch Div.
Twin Disc Clutch Co.

COATINGS, PROTECTIVE
Bakelite Corp.
Bullard Co., Bullard-Dunn Process Div.

COLLARS, Safety
Standard Pressed Steel Co.

Spacings, Etc.
Scully-Jones & Co.

COLLETS
Ames, B. C., Co.
Anker-Holth Mfg. Co.
Brown & Sharpe Mfg. Co.
Cleveland Twist Drill Co.
Gisholt Mch. Co.
Hannifin Mfg. Co.
Hardinge Brothers, Inc.
Jones & Lamson Mch. Co.
Modern Tool Wks.
New Britain-Gridley Mch. Div., New Britain Machine Co.
Pratt & Whitney Co.
Rivett Lathe & Grinder, Inc.
Scully-Jones & Co.
Standard Tool Co.
Stark Tool Co.
Union Twist Drill Co.
Universal Engineering Co.
Wade Tool Co.
Warner & Swasey Co.

COMPARATORS—
See Gages, Comparator.

COMPARATORS, Screw Thread
Jones & Lamson Mch. Co.
Scherr, George, Co., Inc.
Triplex Machine Tool Corp.

COMPOUNDS

Cleaning
Oakite Products, Inc.

Cutting, Grinding, Metal Drawing, Etc.
Cities Service Oil Co.
Gulf Oil Corp.
National Broach & Mch. Co. (Broaching and Lapping)
Oakite Products, Inc.
Shell Oil Co., Inc.
Standard Oil Co., (Indiana)
Stuart, D. A., Oil Co., Ltd.
Sun Oil Co.
Texas Co.
Tide Water Associated Oil Co.

Resin or Molding
Bakelite Corp.
Durez Plastics & Chemicals, Inc.
General Electric Co.

COMPRESSORS, Air.
DeLaval Steam Turbine Co.
Ingersoll-Rand Co.

CONTRACT WORK
Ace Manufacturing Corp.
Bliss, E. W., Co.
Columbus Die, Tool & Mch. Co.
Diefendorf Gear Corp.
Ex-Cell-O Corp.
Hartford Special Mchry. Co.
Hill Acme Co.
Jack & Heintz Precision Industries, Inc.
Kaydon Engrg. Corp.
Langelier Mfg. Co.
LeBlond, R. K., Mch. Tool Co.
Mummert-Dixon Co.
National Acme Co.
Rockford Machine Tool Co.
Taft-Peirce Mfg. Co.
U. S. Tool Co., Inc.
Wade Tool Co.

CONTROLLERS
Allen-Bradley Co.
Bristol Co.
Clark Controller Co.
General Electric Co.
Westinghouse Electric Corp.

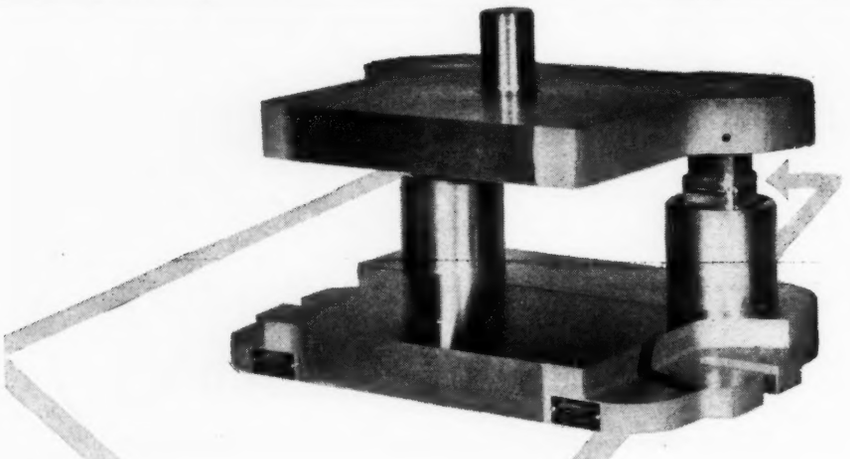
CONVEYOR SYSTEMS
Link-Belt Co.

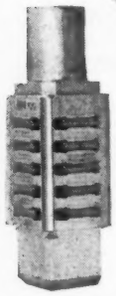
COUNTERBORES
Carboloy Co., Inc.
Cleveland Twist Drill Co.
Ex-Cell-O Corporation
Firth-Sterling Steel Co.
Gairing Tool Co.
Genesee Tool Co.
Haynes Stellite Co.
Kennametal, Inc.
Morse Twist Drill & Mch. Co.
National Tool Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Scully-Jones & Co.
Standard Tool Co.
Starrett, L. S., Co.
Super Tool Co.
Union Twist Drill Co.

COUNTERSHAFTS
LeBlond, R. K., Mch. Tool Co.
Standard Pressed Steel Co.
Warner & Swasey Co.

COUNTERSINKS
Ex-Cell-O Corp.
Gairing Tool Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Scully-Jones & Co.
Standard Tool Co.
Super Tool Co.
Union Twist Drill Co.

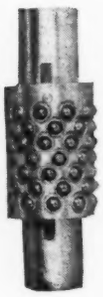
COUNTERS, Revolution
Bristol Co.
Brown & Sharpe Mfg. Co.
Starrett, L. S., Co.
Veeder-Root, Inc.





SQUARE PIN ROLLER BEARING

A New Feature HAS BEEN ADDED



ROUND PIN BALL BEARING

To cut repairs—to reduce downtime—to increase production—use Lempco Anti-Friction Die Sets.

These are the only sets equipped with ball or roller bearing guide pins which makes it easy to set up dies by hand without the use of hammers, mauls, jacks or pry bars. This eliminates expensive accidents to dies and punches—saves up to 60% of mechanics' time and permits fast press speeds.

All bearings made with .0015″ pre-load to eliminate "play" between the pin and bushing. Over 18,000,000 strokes in actual production failed to destroy pre-load and proved that this feature guarantees long die life —assures greater production between sharpenings.

For complete details on the revolutionary Lempco Precision Anti-Friction Die Sets, write for catalog.

LEMPCO

5762 DUNHAM RD., BEDFORD, OHIO, U.S.A.

COUNTING DEVICES
Starrett, L. S., Co.
Veeder-Root, Inc.

COUPLINGS

Flexible
Atlantic Gear Works, Inc.
Boston Gear Works, Inc.
Eberhardt-Denver Co.
Farrel-Birmingham Co., Inc.
Foote Bros. Gear & Machine Corp.
Lovejoy Flexible Coupling Co.
Morse Chain Co.
Philadelphia Gear Works

Pipe, Tubes, Etc.
Dart, E. M., Mfg. Co.

Shaft
Boston Gear Works, Inc.
Foote Bros. Gear & Machine Corp.
Hilliard Corp.
Sellers, Wm., & Co., Inc.
Standard Pressed Steel Co.

CRANES, Electric Traveling
Morgan Engineering Co.
Shepard Niles Crane & Hoist Corp.

Hand Traveling
Shepard Niles Crane & Hoist Corp.

Locomotives
Cullen-Friestedt Co.
Hill Acme Co.

CUTTER GRINDERS
See Grinding Machines, Universal, for Sharpening Cutters, Reamers, Hobs, Etc.

CUTTERS, Gear
Brown & Sharpe Mfg. Co.
Ex-Cell-O Corp.
Fellows Gear Shaper Co.
Illinois Tool Works
Michigan Tool Co.
Morse Twist Drill & Mch. Co.
National Broach & Mch. Co. (Gear Shaper)
National Tool Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Standard Tool Co.
Union Twist Drill Co.
Waltham Mch. Wks.

Milling
Barber-Colman Co.
Brown & Sharpe Mfg. Co.
Carboloy Co., Inc.
Columbus Die, Tool & Machine Co.
Detroit Tap & Tool Co.
Ex-Cell-O Corp.
Firth-Sterling Steel Co.
Gairing Tool Co.
Gammons-Hoaglund Co.
Genesee Tool Co.
Gorton, George, Mch. Co.
Haynes Stellite Co.
Illinois Tool Works
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Kennametal, Inc.
McCrosky Tool Corp.
Modern Tool Wks.
Morse Twist Drill & Mch. Co.
National Tool Co.
National Twist Drill & Tool Co.
Nelco Tool Co.
Pratt & Whitney Co.
Producto Machine Co.
Reed-Prentice Corp.
Scully-Jones Co.
Standard Tool Co.
Super Tool Co.
Union Twist Drill Co.

CUTTING COMPOUNDS
See Compounds, Cutting, Grinding, Etc.

CUTTING-OFF MACHINES
Avey Drilling Machine Co.
Bardons & Oliver, Inc.
Bridgeport Safety Emery Wheel Co., Inc.
Brown & Sharpe Mfg. Co.
Consolidated Mch. Tool Corp.
Landis Machine Co.

Abrasive Wheel
Armstrong Brothers Tool Co.
Bridgeport Safety Emery Wheel Co., Inc.
Campbell, Andrew C., Div. American Chain & Cable Co., Inc.
Delta Manufacturing Co.

Cold Saw
See Sawing Machines, Circular.

CUTTING-OFF TOOLS
Armstrong Brothers Tool Co.
Empire Tool Co.
Firth-Sterling Steel Co.
Haynes Stellite Co.
Illinois Tool Works
Luers, J. Milton
Pratt & Whitney Co.
Williams, J. H., & Co.

CUTTING-OFF WHEELS, Abrasive
Bay State Abrasive Co.
Carborundum Co.
Norton Co.
Raybestos-Manhattan, Inc., Manhattan-Rubber Div.

Added POWER to PUSH PULL LIFT or lower

ANKER-HOLTH NON-ROTATING CYLINDERS AIR and HYDRAULIC

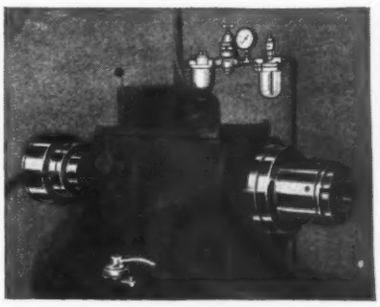
Note precision construction and ease of disassembling.

"AIRGRIP" Non-Rotating Cylinder mounted on tailstock of Sundstrand Lathe.

ANKER-HOLTH CYLINDERS are valuable time-saving "tools" for multiplying the production capacity of your present equipment, and are adaptable to many different applications in your shop.

HI-POWER DOUBLE-ACTING NON-ROTATING CYLINDERS, either air or hydraulic, deliver fast, smooth, dependable power. They are available in a variety of mountings and with any length of stroke to meet your individual requirements. *Extra* strong cylinder walls (9/16" thick); no tie rods; makes servicing easy — either end of cylinder quickly removable.

AIRGRIP



"AIRGRIP" Rotating Cylinder, Air Regulating Valve and Lubricating Assembly, 4-way Hand Control Valve and Standard Parallel Grip Collet Chuck in a typical installation.

OTHER ANKER-HOLTH PRODUCTS—Air or Hydraulic 3- and 2-jaw Chucks, Collets, Arbors, Drill Press Chuck and Cylinder Combinations, 2- and 3-Jaw Finger and Compensating Chucks, Regulating Valve and Lubricator Assemblies, 3- or 4-Way Air Valves (hand or foot operated), Pressure Regulating Valves, Hydraulic Supercharged Power Units.

ANKER-HOLTH MFG. CO. 2727 CONNORS ST., PORT HURON, MICH.
Representatives in All Principal Cities 1720 M

When buying new lathes, specify "AIRGRIP" Chucks and Cylinders

CYLINDER BORING MACHINES
Baker Brothers, Inc.
Barnes Drill Co.
Consolidated Mch. Tool Corp.
Cross Co.
Ex-Cell-O Corp.
Ingersoll Milling Mch. Co.
Moline Tool Co.
Sellers, Wm., & Co., Inc.

CYLINDERS, Hydraulic
American Hollow Boring Co.
Anker-Holth Mfg. Co.
Barnes, John S., Corp.
Clearing Mch. Corp.
Denison-Engineering Co.
Galland-Henning Mfg. Co.
Hanna Engrg. Works
Hannifin Mfg. Co.
Hydraulic Press Mfg. Co.
Hydraulic Products Co.
Logansport Machine Co., Inc.
Rockford Machine Tool Co.
Skinner Chuck Co.

Pneumatic
Anker-Holth Mfg. Co.
Clearing Mch. Corp.
Hanna Engrg. Works
Hannifin Mfg. Co.
Hydraulic Products Co.
Skinner Chuck Co.

DEALERS, Machinery
Besly, Chas. H., & Co.
Earle Gear & Mch. Co.
Lunden & Bonthron
Ryerson, Joseph T., & Son, Inc.
Simmons Machine Tool Corp.

DEMAGNETIZERS
Blanchard Mch. Co.
Heald Machine Co.
Ideal Industries, Inc.
Walker, O. S., Co., Inc.

DESIGNERS, Machine and Tool
American Tool Engineering Co.
Ex-Cell-O Corp.
Hartford Special Mchry. Co.
Jones, C. K., Inc.
Ruthman Mchry. Co.
Vinco Corporation

DIAMONDS and Diamond Tools
Desmond-Stephan Mfg. Co.
Raybestos-Manhattan, Inc., Manhattan-Rubber Div.
Smit, J. K., & Co.
Super Tool Co.

DIE CASTING MACHINES
Hydraulic Press Mfg. Co.
Kux Machine Co.
Lester-Phoenix, Inc.
Madison-Kipp Corp.
Reed-Prentice Corp.

DIE CASTING
See Castings, Die.

DIE CUSHIONS, Pneumatic
Bliss, E. W., Co.
Clearing Mch. Corp.
Verson Allsteel Press Co.

DIE INSERTS, Carbide
Carboloy Co., Inc.
Firth-Sterling Steel Co.
Kennametal, Inc.

DIE MAKERS' SUPPLIES
Baumbach, E. A., Mfg. Co.
Danly Mch. Specialties, Inc.
U. S. Tool Company, Inc.

DIE MAKING MACHINES
Grob Brothers
Kearney & Trecker Corp.
Oliver Instrument Co.

DIE SETS, Standard
Baumbach, E. A., Mfg. Co.
Danly Mch. Specialties, Inc.
Pratt & Whitney Co.
Producto Machine Co.

DIE SINKING MACHINES
Cincinnati Milling Mch. Co.
Gorton, George, Mch. Co.
Pratt & Whitney Co.
Reed-Prentice Corp.

DIE SINKING PRESSES
Baldwin-Southwark Corp.
Kearney & Trecker Corp.

DIE STOCKS
See Stocks, Die.

DIES, Lettering and Embossing
Noble & Westbrook Mfg. Co.

DIES

Sheet Metal, Etc.
Baumbach, E. A., Mfg. Co.
Bliss, E. W., Co.
Columbus Die, Tool & Mch. Co.
Niagara Mch. & Tool Wks.
Peck, Stow & Wilcox Co.
Ruthman Mchry. Co.
Taft-Peirce Mfg. Co.
Verson Allsteel Press Co.
V & O Press Co.
Wade Tool Co.
Waltham Mch. Wks.

Threading
Butterfield Div., Union Twist Drill Co
Card, S. W., Mfg. Co.
Eastern Mch. Screw Corp.
Geometric Tool Co.
Greenfield Tap & Die Corp.
Hill Acme Co.
Jones & Lamson Mch. Co.
Landis Mch. Co., Inc.
Modern Tool Works
Morse Twist Drill & Mch. Co.
National Acme Co.
Oster Manufacturing Co.
Pratt & Whitney Co.
Standard Tool Co.

Threading Opening
Eastern Mch. Screw Corp.
Errington Mechanical Laboratory
Geometric Tool Co.
Hill Acme Co.
Jones & Lamson Mch. Co.
Landis Mch. Co., Inc.
Modern Tool Works
National Acme Co.
Oster Manufacturing Co.

Thread Rolling
Hanson-Whitney Mch. Co.
Pratt & Whitney Co.

DISCS, Abrasive
Besly, Chas. H., & Co.
Carborundum Co.
Gardner Mch. Co.
Norton Co.
Raybestos-Manhattan, Inc., Manhattan-Rubber Div.
Simonds Abrasive Co.
Walls Sales Corp.

DIVIDING HEADS
See Index Centers.

DOWEL PINS
Allen Mfg. Co.
Baumbach, E. A., Mfg. Co.
Danly Mch. Specialties, Inc.
U. S. Tool Co., Inc.

DRAFTING MACHINES
Universal Drafting Machine Co.

DRAWING BOARDS AND TABLES
Universal Drafting Machine Co.

DRESSERS, Grinding Wheel
American Gauge Co.
Carboloy Co., Inc.
Desmond-Stephan Mfg. Co.
Hanchett Mfg. Co.
Ideal Industries, Inc.
Norton Co.
Smit, J. K., & Co.
Standard Tool Co.
Super Tool Co.
Vinco Corporation

DRIFTS, DRILL
Armstrong Bros. Tool Co.
Standard Tool Co.

DRILL HEADS

Unit Type
Barnes Drill Co.
Rehnberg-Jacobson Mfg. Co.

Multiple
Baker Brothers, Inc.
Barnes Drill Co.
Buffalo Forge Co.
Buhr Machine Tool Co.
Delta Manufacturing Co.
Errington Mechanical Laboratory
Ettco Tool Co.
Ex-Cell-O Corp.
Hoefer Mfg. Co.
Langelier Mfg. Co.
Moline Tool Co.
National Automatic Tool Co.
Thriftmaster Products, Div. Thomson Industries, Inc.

DRILL SOCKETS
Armstrong Bros. Tool Co.
Cleveland Twist Drill Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.

PRECISION GENERATED

INTERNAL GEARS

UP TO 18 FEET DIAMETER

In the swing mechanisms of power shovels and ladder trucks, in machine tools, and in numerous other applications, Farrel precision generated internal gears are giving efficient, long-life performance under severe operating conditions.

Their smooth, quiet operation is due to accuracy of tooth contour and tooth spacing inherent in the famous Farrel-Sykes method by which the teeth are generated.

You can get Farrel internal gears in any size up to 18-feet diameter, 12-inch face, 1¼ DP, precision generated with either spur or single helical teeth.

Internal gears frequently meet design and operating conditions better than other types and their availability in large sizes has extended their advantages to many applications where size limitations formerly prevented their use.

Next time you need internal gears, the facilities and experience of the Farrel organization in the design, manufacture and operation of gearing of all types are at your service.

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344 VULCAN ST., BUFFALO 7, N.Y.

Plants: Ansonia, Derby and Stonington, Conn., Buffalo, N.Y.
Sales Offices: Ansonia, Buffalo, New York, Pittsburgh, Akron, Los Angeles, Tulsa, Houston, Charlotte.

This Farrel precision generated internal spur gear has 108 teeth, 1½ DP, 4¾" face, 72.225" ID. The pinion has 13 teeth, 1½ DP, 5⅛" face, 10.358" OD.

F3-311

Farrel-Birmingham

Pratt & Whitney Co.
Scully-Jones & Co.
Standard Tool Co.
Union Twist Drill Co.

DRILL SPEEDERS

Graham Mfg. Co., Inc.
Hoefer Mfg. Co.

DRILL STANDS

Cleveland Twist Drill Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Standard Tool Co.
Union Twist Drill Co.

DRILLING MACHINES

Automatic

Avey Drilling Machine Co.
Baker Brothers, Inc.
Barnes Drill Co.
Barnes, W. F., & John Co.
Bodine Corp.
Bradford Machine Tool Co.
Buhr Machine Tool Co.
Consolidated Mch. Tool Corp.
Cross Co.
Grant Mfg. & Mch. Co.
Hoefer Mfg. Co.
Kingsbury Mch. Tool Corp.
Langelier Mfg. Co.
National Automatic Tool Co.

Bench

Ames, B. C., Co.
Atlas Press Co.
Avey Drilling Machine Co.
Buffalo Forge Co.
Delta Manufacturing Co.
Dumore Co.
Elgin Tool Wks., Inc.
Fosdick Machine Tool Co.
Henry & Wright Mfg. Co.
Langelier Mfg. Co.
Leland-Gifford Co.
Moline Tool Co.
Production Machine Co.
Taylor Mfg. Co.
Walker-Turner Co., Inc.

Boiler

Cincinnati Bickford Tool Co.
Foote-Burt Co.
Sellers, Wm., & Co., Inc.

Gang

Avey Drilling Machine Co.
Baker Brothers, Inc.
Barnes Drill Co.
Cincinnati Bickford Tool Co.
Consolidated Mch. Tool Corp.
Cross Co.
Delta Manufacturing Co.
Foote-Burt Co.
Fosdick Machine Tool Co.
Ingersoll Milling Mch. Co.
Langelier Mfg. Co.
Leland-Gifford Co.
Moline Tool Co.
National Automatic Tool Co.
Production Machine Co.
Producto Machine Co.
Sellers, Wm., & Co., Inc.

Horizontal Duplex

Avey Drilling Machine Co.
Baker Brothers, Inc.
Barnes Drill Co.
Barnes, W. F. & John, Co.
Bradford Machine Tool Co.
Consolidated Mch. Tool Corp.
Cross Co.
Davis & Thompson Co.
Frew Machine Co.
Kingsbury Mch. Tool Corp.
Langelier Mfg. Co.
National Automatic Tool Co.
Sellers, Wm., & Co., Inc.
Sundstrand Mch. Tool Co.

Inverted

Baker Brothers, Inc.
Barnes Drill Co.

Multiple Center Column Type

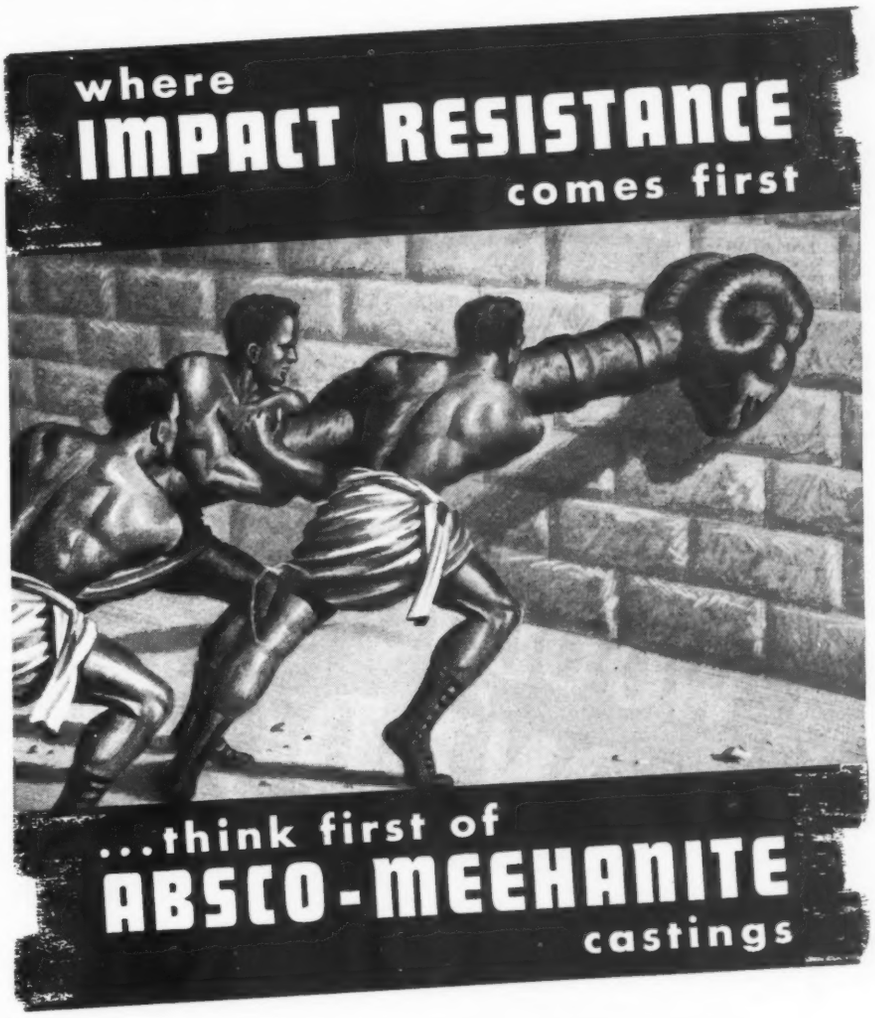
Barnes Drill Co.

Multiple Spindle

Avey Drilling Machine Co.
Baker Brothers, Inc.
Barnes Drill Co.
Barnes, W. F. & John, Co.
Baush Machine Tool Co.
Bradford Machine Tool Co.
Buffalo Forge Co.
Buhr Machine Tool Co.
Cincinnati Bickford Tool Co.
Cross Co.
Delta Manufacturing Co.
Foote-Burt Co.
Fosdick Machine Tool Co.
Greenlee Bros. & Co.
Henry & Wright Mfg. Co.
Ingersoll Milling Mch. Co.
Kingsbury Mch. Tool Corp.
Langelier Mfg. Co.
Leland-Gifford Co.
Moline Tool Co.
National Automatic Tool Co.
Pratt & Whitney Co.
Production Mch. Co.
Sellers, Wm., & Co., Inc.
Taylor & Fenn Co.

Radial

American Tool Wks. Co.
Carlton Machine Tool Co.
Cincinnati Bickford Tool Co.
Foote-Burt Co.
Fosdick Machine Tool Co.
Giddings & Lewis Mch Tool Co.
Sellers, Wm., & Co., Inc.



We produce three main classifications of Absco-Meehanite, and within them nine types upon which to base your considerations. Because of the wide range of physical properties such a selection affords, Absco-Meehanite Castings make possible a remarkably high degree of control in matching the metal to its specific job. For example, if impact resistance is an all-important consideration, you can get it in combination with other properties as demanded.

In the case of the die part illustrated, impact-resistant Absco-Meehanite Castings were produced which not only withstood repeated heavy blows by an air hammer, but provided the rigidity and wear resistance that were also needed to hold its shape in the forming of stainless steel.

If your need for castings is on a production-schedule basis . . . if "unusual castings for unusual service" is of particular interest to you . . . if you think that American Brake Shoe Company's practical knowledge of foundry techniques may be of help to you, write us — in detail.

AMERICAN Brake Shoe COMPANY

BRAKE SHOE AND CASTINGS DIVISION
230 Park Ave., New York 17, N. Y.

ABSCO-MEEHANITE PROPERTIES

1. Strength (Shear, Compressive, Tensile and Transverse)
2. Impact Resistance
3. Corrosion Resistance
4. Wear Resistance
5. Heat Resistance
6. Toughness
7. Rigidity
8. Machinability
9. Pressure Tightness
10. Vibration Absorption

4468

Rail
See Drilling Machines, Gang.
Sensitive
Atlas Press Co.
Avey Drilling Machine Co.
Buffalo Forge Co.
Delta Manufacturing Co.
Foote-Burt Co.
Fosdick Machine Tool Co.
Henry & Wright Mfg. Co.
Langelier Mfg. Co.
Leland-Gifford Co.
Moline Tool Co.
National Automatic Tool Co.
Pratt & Whitney Co.
Production Mch. Co.
Producto Machine Co.
Rivett Lathe & Grinder, Inc.
Ryerson, Joseph T., & Son, Inc.
Taylor & Fenn Co.
Taylor Mfg. Co.
Upright
Atlas Press Co.
Avey Drilling Machine Co.
Baker Brothers, Inc.
Barnes Drill Co.
Barnes, W. F. & John, Co.
Buffalo Forge Co.
Cincinnati Bickford Tool Co.
Consolidated Mch. Tool Corp.
Cross Co.
Davis & Thompson Co.
Delta Manufacturing Co.
Foote-Burt Co.
Fosdick Machine Tool Co.
Hoefer Mfg. Co.
Ingersoll Milling Mch. Co.
Langelier Mfg. Co.
Leland-Gifford Co.
Moline Tool Co.
National Automatic Tool Co.
Production Mch. Co.
Producto Machine Co.
Rehnberg-Jacobson Mfg. Co.
Rogers Machine Works, Inc.
Ryerson, Joseph T., & Son, Inc.
Sellers, Wm., & Co., Inc.
Taylor Mfg. Co.
Wall Radial
Cleveland Punch & Shear Works Co.
Consolidated Mch. Tool Corp.

DRILLS
Center
Cleveland Twist Drill Co.
Gairing Tool Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Standard Tool Co.
Union Twist Drill Co.
Warner & Swasey Co.
Core
Carboloy Co., Inc.
Ex-Cell-O Corp.
Firth-Sterling Steel Co.
Gairing Tool Co.
Haynes Stellite Co.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Scully-Jones & Co.
Standard Tool Co.
Super Tool Co.
Union Twist Drill Co.
Portable Electric
Dumore Co.
Ryerson, Joseph T., & Son, Inc.
Portable Pneumatic
Ingersoll-Rand Co.
Rotor Tool Co.
Ratchet
Armstrong Bros. Tool Co.
Cleveland Twist Drill Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Standard Tool Co.
Union Twist Drill Co.
Twist
Carboloy Co., Inc.
Cleveland Twist Drill Co.
Firth-Sterling Steel Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Republic Drill & Tool Co.
Standard Tool Co.
Super Tool Co.
Union Twist Drill Co.
Wire
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Standard Tool Co.
Union Twist Drill Co.

DUPLICATORS
Rockford Machine Tool Co.

DUST CONTROL SYSTEMS
Pangborn Corp.
Schneible, Claude B., Co.

DYNAMOMETERS
Taylor Mfg. Co.

ELECTRICAL EQUIPMENT
Feedrail Corp.
General Electric Co.
Ideal Industries, Inc.
Westinghouse Electric Corp.

ELEVATORS
Otis Elevator Co.

EMERY WHEELS
See Grinding Wheels.

EMERY WHEEL DRESSERS
See Dressers, Grinding Wheel.

ENGRAVING MACHINES
Gorton, George, Mch. Co.

EXTRACTORS, Screw
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.

FACING MACHINE
Ex-Cell-O Corp.

FACING TOOLS
Clark, Robert H., Co.

FANS, Exhaust, Electric Ventilating
Buffalo Forge Co.
General Electric Co.

FEEDS FOR PRESSES, Automatic
Cleveland Punch & Shear Works Co.
Peck, Stow & Wilcox Co.
S. & S. Machine Wks.
U. S. Tool Co., Inc.
V & O Press Co.

FILES
Simonds Saw & Steel Co.
Machine
Oliver Instrument Co.
Rotary
Haskins, R. G., Co.
Lewis, B. C., Mfg. Co., Inc.
Lincoln Park Industries, Inc.
Pratt & Whitney Co.
Strand, N. A., & Co.

FILTERS, AIR
United States Electrical Tool Co.

FILTERS, COOLANT AND OIL
Cuno Engineering Corp.

FILING MACHINES, Dies, Etc.
Ames, B. C., Co.
DoAll Co.
Grob Brothers
Illinois Tool Wks.
Oliver Instrument Co.

FITTINGS, HYDRAULIC
Hydraulic Press Mfg. Co.
Watson-Stillman Co.

FLEXIBLE COUPLINGS
See Couplings, Flexible.

FLEXIBLE SHAFT EQUIPMENT
Dumore Co.
Haskins, R. G., Co.
Lewis, B. C., Mfg. Co., Inc.
Pratt & Whitney Co.
Strand, N. A., & Co.
Walker-Turner Co., Inc.
Wyzenbeek & Staff, Inc.

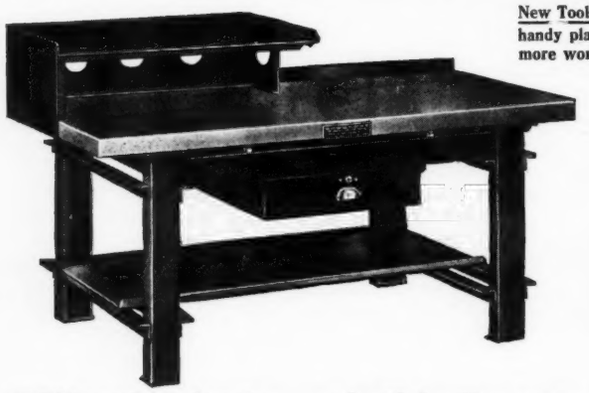
FORGING (Upsetting) MCHS.
Ajax Manufacturing Co.
Baldwin-Southwark Corp.
Hill Acme Co.
National Machinery Co.

FORGINGS
Drop
Bethlehem Steel Co.
Drop Forging Association
Kropp Forge Co.
Merrill Bros.
Williams, J. H., & Co.
Hollow Bored
American Hollow Boring Co.
Bethlehem Steel Co.
Iron and Steel
Bethlehem Steel Co.
Commercial Forgings Co.
Jones & Laughlin Steel Corp.
Kropp Forge Co.
Morgan Engineering Co.
Steel Improvement & Forge Co.

WOOD TOPS WON'T DO

for "All-Out" Production

use CHALLENGE *Cast-Iron Top* WORK BENCHES



New Tool Box Shelf provides handy place for tool box . . . more work space on bench.

NO WARPING

NO SPLINTERS

NO FIRE HAZARD

● Old wood top benches just don't fit in today's industrial set-up! Modern plants, geared for peak production, need Challenge *Cast-Iron Top* Work Benches.

These benches are ruggedly built for fast, full-time production. Equipped with leveling screws on full length braces to assure a level surface. Top and all four sides carefully machined at right angles; under-side heavily ribbed.

Made in four standard sizes. Send for illustrated Challenge catalog. 410

THE CHALLENGE MACHINERY CO.

GRAND HAVEN Challenge MICHIGAN

Manganese, Bronze, Etc.
Cramp Brass & Iron Foundries Div.

Upset
Bethlehem Steel Co.
Kropp Forge Co.
Williams, J. H., & Co.

FORMING AND BENDING MCHS.
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Bethlehem Steel Co.
Cincinnati Shaper Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. Tool Corp.
Hannifin Mfg. Co.
Hydraulic Press Mfg. Co.
O'Neil-Irwin Mfg. Co.
Yoder Co.

FORMING AND STAMPING MCHS.
Cincinnati Shaper Co.
U. S. Tool Co., Inc.

FORMING TOOLS or Tool Blanks
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Firth-Sterling Steel Co.
National Broach & Mch. Co.
Pratt & Whitney Co.

FRAMES, Machinery, Welded
Mahon, R. C., Co.

FRICTION MATERIAL (Brake Lining & Clutch Facing)
Raybestos-Manhattan, Inc., Manhattan-Rubber Div.

FURNACES, Equipment for Loading
Hydraulic Products Co.

Hardness
Leeds & Northrup Co.

Heat-Treating
Cooley Electric Mfg. Co.
General Electric Co.
Johnson Gas Appliance Co.
Leeds & Northrup Co.
Westinghouse Electric Corp.

FURNITURE, Shop
Standard Pressed Steel Co.

GAGE BLOCKS
Johansson Div., Ford Motor Co.
Pratt & Whitney Co.
Scherr, George, Co., Inc.
Van Keuren Co.

GAGES, Comparator
American Measuring Instruments Corp.
Comtor Co.
Federal Products Corp.
Jones & Lamson Machine Co.
Pratt & Whitney Co.
Scherr, George, Co., Inc.
Sheffield Corp.
Woodworth, N. A., Co.

Depth
Brown & Sharpe Mfg. Co.
Federal Products Corp.
Scherr, George, Co., Inc.
Standard Gage Co., Inc.
Starrett, L. S., Co.

Dial
Ames, B. C., Co.
Bristol Co.
Brown & Sharpe Mfg. Co.
Federal Products Corp.
Scherr, George, Co., Inc.
Sheffield Corp.
Standard Gage Co., Inc.
Starrett, L. S., Co.

Electric
Pratt & Whitney Co.

Height
Brown & Sharpe Mfg. Co.
Scherr, George, Co., Inc.
Standard Gage Co.
Starrett, L. S., Co.

Plug, Ring and Snap
American Gauge Co.
Axelson Mfg. Co.
Brown & Sharpe Mfg. Co.
Carboloy Co., Inc.
Ex-Cell-O Corp.
Federal Products Corp.
Firth-Sterling Steel Co.
Greenfield Tap & Die Corp.
Haynes Stellite Co.
Kennametal, Inc.
Lincoln Park Industries, Inc.
Merz Engineering Co.
Morse Twist Drill & Machine Co.
Pratt & Whitney Co.
Scherr, George, Co., Inc.
Sheffield Corp.
Size Control Co.
Standard Gage Co., Inc.
Starrett, L. S., Co.
Van Keuren Co.
Vinco Corp.
Woodworth, N. A., Co.

Surface
Brown & Sharpe Mfg. Co.
Columbus Die, Tool & Mch. Co.
Standard Gage Co., Inc.
Starrett, L. S., Co.

Taper
Brown & Sharpe Mfg. Co.
Johansson Div., Ford Motor Co.
Pratt & Whitney Co.
Sheffield Corp.
Standard Gage Co., Inc.
Starrett, L. S., Co.
Vinco Corporation

Thread
American Gauge Co.
Axelson Mfg. Co.
Bath, John, & Co., Inc.
Brown & Sharpe Mfg. Co.
Detroit Tap & Tool Co.
Federal Products Corp.
Greenfield Tap & Die Corp.
Hanson-Whitney Machine Co.
Jones & Lamson Machine Co.
Lincoln Park Industries, Inc.
Merz Engineering Co.
Pratt & Whitney Co.
Sheffield Corp.
Size Control Co.
Starrett, L. S., Co.
Vinco Corporation
Woodworth, N. A., Co.

GASKETS
Garlock Packing Co.
Raybestos-Manhattan, Inc., Manhattan-Rubber Div.

GEAR BLANKS, Non-Metallic
Braun Gear Co.
Ganschow Gear Co.
General Electric Co.
Westinghouse Electric Corp.

GEAR BURNISHING MACHINES
Fellows Gear Shaper Co.

GEAR CHECKING INSTRUMENTS AND EQUIPMENT
Brown & Sharpe Mfg. Co.
Fellows Gear Shaper Co.
Gleason Works
Illinois Tool Works
Michigan Tool Co.
National Broach & Mch. Co.
Pratt & Whitney Co.
Scherr, George, Co., Inc.
Vinco Corporation

GEAR CUTTING MACHINES, Bevel (Generator)
Bilgram Gear & Machine Wks.
Gleason Works

(Rotary Cutter)
Newark Gear Cutting Machine Co.
Producto Machine Co.
Waltham Mch. Wks.

GEAR CUTTING MACHINES, Helical and Spur (Hob)
Barber-Colman Co.
Farrel-Birmingham Co., Inc.

(Shaper or Planer Type)
Fellows Gear Shaper Co.
National Tool Co.
Newark Gear Cutting Machine Co.
New Jersey Gear & Mfg. Co.
Triplex Machine Tool Corp.

Shear-speed Type
Michigan Tool Co.

GEAR CUTTING MACHINES, Spiral-Bevel
Gleason Works

GEAR CUTTING MACHINES, Worm and Worm Wheels
Barber-Colman Co.
Fellows Gear Shaper Co.

(Straight and Hourglass Type)
New Jersey Gear & Mfg. Co.
Producto Machine Co.

GEAR FINISHING MACHINES
Fellows Gear Shaper Co.
Michigan Tool Co.

GEAR GRINDING MACHINES
Fitchburg Grinding Mch. Corp.
Gleason Works
Pratt & Whitney Co.
Vinco Corporation

GEAR HARDENING MACHINES
Fellows Gear Shaper Co.
Gleason Works

GEAR LAPPING MACHINES
Fellows Gear Shaper Co.
Gleason Works
Michigan Tool Co.
National Broach & Mch. Co.

GEAR MOTORS
See Speed Reducers.

GEAR SHAVING MACHINES
Fellows Gear Shaper Co.
National Broach & Mch. Co.

GEAR TESTING MACHINERY
Baldwin-Southwark Corp.
Brown & Sharpe Mfg. Co.
Farrel-Birmingham Co., Inc.
Fellows Gear Shaper Co.
National Tool Co.
Newark Gear Cutting Machine Co.
Pratt & Whitney Co.
Scherr, George, Co., Inc.
Vinco Corp.

GEAR TOOTH GRINDING REST
Utility Tool & Mfg. Co.

GEARS

Cut
Atlantic Gear Works, Inc.
Automotive Gear Works, Inc.
Baush Machine Tool Co.
Beaver Gear Works, Inc.
Bethlehem Steel Co.
Bilgram Gear & Machine Works
Boston Gear Works, Inc.
Braun Gear Co.
Cincinnati Gear Co.
Cleveland Worm & Gear Co.
DeLaval Steam Turbine Co.
Detroit Bevel Gear Co.
Diefendorf Gear Corp.
Earle Gear & Mch. Co.
Eberhardt-Denver Co.
Fairfield Mfg. Co.
Farrel-Birmingham Co., Inc.
Fellows Gear Shaper Co.
Foote Bros. Gear & Machine Corp.
Ganschow Gear Co.
Gear Specialties
General Electric Co.
Gleason Works
Grant Gear Wks., Inc.
Hartford Special Mchy. Co.
Massachusetts Gear & Tool Co.
Meisel Press Mfg. Co.
Michigan Tool Co.
Newark Gear Cutting Machine Co.
New Jersey Gear & Mfg. Co.
Ohio Gear Co.
Perkins Mch. & Gear Co.
Philadelphia Gear Works
Pittsburgh Gear & Machine Co.
Richmond Hill Gear Co.
Sier-Bath Co.
Stahl Gear & Machine Co.
Taylor Mch. Co.
Westinghouse Electric Corp.

Molded
Foote Bros. Gear & Machine Corp.
Philadelphia Gear Works
Westinghouse Electric Corp.

Rawhide and Non-Metallic
Atlantic Gear Works, Inc.
Boston Gear Works, Inc.
Braun Gear Co.
Cincinnati Gear Co.
Diefendorf Gear Corp.
Earle Gear & Mch. Co.
Foote Bros. Gear & Machine Corp.
Ganschow Gear Co.
General Electric Co.
Grant Gear Works, Inc.
Hartford Special Mchy. Co.
Massachusetts Gear & Tool Co.
Meisel Press Mfg. Co.
Philadelphia Gear Works
Pittsburgh Gear & Machine Co.
Stahl Gear & Machine Co.
Taylor Mch. Co.
Westinghouse Electric Corp.

GENERATORS, ELECTRIC
General Electric Co.
Master Electric Co.
Reliance Electric & Mfg. Co.
Westinghouse Electric Corp.

GOGGLES
American Optical Co.

GRADUATING MACHINES
Gorton, George, Mch. Co.
Noble & Westbrook Mfg. Co.

GREASE
Cities Service Oil Co.
Gulf Oil Corp.
Shell Oil Co., Inc.
Standard Oil Co. (Indiana)
Sun Oil Co.
Texas Co.
Tide Water Associated Oil Co.

GRINDERS

Carbide Tool
Oliver Instrument Co.
Sundstrand Mch. Tool Co.

Die and Mold
Consolidated Mch. Tool Corp.
Dumore Co.
Haskins, R. G., Co.
Pratt & Whitney Co.

Oilstone, for Woodworking Tools
Mummert-Dixon Co.

Pneumatic
Cleveland Pneumatic Tool Co.
Ingersoll-Rand Co.
Madison-Kipp Corp.
Rotor Tool Co.

Portable Electric and Toolpost
Dumore Co.
Haskins, R. G., Co.

GRINDING MACHINES

Abrasive Belt
Delta Manufacturing Co.
DoAll Co.
Hill Acme Co.
Mattison Mch. Wks.
Porter-Cable Machine Co.
Production Machine Co.
Walker-Turner Co., Inc.
Walls Sales Corp.

Bench
Atlas Press Co.
Delta Manufacturing Co.
Hardinge Brothers, Inc.
Rivett Lathe & Grinder, Inc.
Ryerson, Joseph T., & Son, Inc.
Walker-Turner Co., Inc.

Broach
Gear Grinding Machine Co.

Camshaft
Landis Tool Co.
Norton Co.

Carbide Tool
Carboloy Co., Inc.
Ex-Cell-O Corp.
Hager, E. F., & Son
Oliver Instrument Co.

Centerless
Cincinnati Grinders, Inc.
Heald Machine Co.
Landis Tool Co.
Triplex Machine Tool Corp.

Chaser or Die
Eastern Mch. Screw Corp.
Fitchburg Grinding Mch. Corp.
Geometric Tool Co.
Landis Machine Co., Inc.

Chucking
Bryant Chucking Grinder Co.
Fitchburg Grinding Mch. Corp.

Crankshaft
Landis Tool Co.
Norton Co.

Cylinder
Bryant Chucking Grinder Co.
Heald Machine Co.
Landis Tool Co.

Cylindrical
Arter Grinding Machine Co.
Brown & Sharpe Mfg. Co.
Cincinnati Grinders, Inc.
Fitchburg Grinding Mch. Corp.
Landis Tool Co.
Modern Tool Wks.
(Cons. Mch. Tool Corp.)
Morse Twist Drill & Mch. Co.
Norton Co.
Pratt & Whitney Co.
Rivett Lathe & Grinder, Inc.
Thompson Grinder Co.
Triplex Machine Tool Corp.

Disc
Besly, Chas. H., & Co.
Gardner Machine Co.
Hanchett Mfg. Co.
Porter-Cable Machine Co.
Production Mch. Co.

Drill
Delta Manufacturing Co.
Gallmeyer & Livingston Co.
Oliver Instrument Co.
Sellers, Wm., & Co., Inc.
Union Twist Drill Co.

Face
Abrasive Mch. Tool Co.
Hanchett Mfg. Co.
Oliver Instrument Co.

Flexible Shaft
See Flexible Shaft Equipment.

Gear Tooth
Gear Grinding Machine Co.
National Tool Co.
Pratt & Whitney Co.

For Sharpening Turning and Planing Tools
Delta Manufacturing Co.
Oliver Instrument Co.
Production Mch. Co.
Sellers, Wm., & Co., Inc.
Walker, O. S., Co., Inc.
Waltham Mch. Wks.

Internal
Bryant Chucking Grinder Co.
Heald Machine Co.
Landis Tool Co.
Modern Tool Wks.
(Cons. Mch. Tool Corp.)
Rivett Lathe & Grinder, Inc.

Jig
Moore Special Tool Co., Inc.

Knife and Shear Blade
Bridgeport Safety Emery Wheel Co., Inc.
Hill Acme Co.

Piston Ring
Arter Grinding Machine Co.
Bridgeport Safety Emery Wheel Co., Inc.
Heald Machine Co.

Profile
Boyar-Schultz Corp.

Pulleys
Abrasive Mch. Tool Co.

Radial, Ball Race, Etc.
Landis Tool Co.

Radius, Link
Consolidated Mch. Tool Corp.
Sundstrand Mch. Tool Co.

Ring Wheel
Besly, Chas. H., & Co.
Bridgeport Safety Emery Wheel Co., Inc.
Gardner Machine Co.

Roll
Farrel-Birmingham Co., Inc.
Landis Tool Co.
Norton Co.

Spline
Fitchburg Grinding Machine Corp.
Gear Grinding Machine Co.
Vinco Corporation

Surface
Abrasive Mch. Tool Co.
Arter Grinding Machine Co.
Blanchard Mch. Co.
Brown & Sharpe Mfg. Co.
DoAll Co.
Foote-Burt Co.
Gallmeyer & Livingston Co.
Gardner Mch. Co.
Hanchett Mfg. Co.
Heald Machine Co.
Hill Acme Co.
Mattison Machine Works
Norton Co.

Pratt & Whitney Co.
Producto Machine Co.
Reid Bros. Co., Inc.
Robot Machinery Co.
Thompson Grinder Co.
Walker, O. S., Co., Inc.

Tap

Ex-Cell-O Corp.
Jones & Lamson Mch. Co.

Thread

Ex-Cell-O Corp.
Jones & Lamson Mch. Co.
Landis Machine Co., Inc.

Universal, for Sharpening Cutters, Reamers, Hobs, Etc.

Barber-Colman Co.
Brown & Sharpe Mfg. Co.
Cincinnati Milling Mch. Co.
DoAll Co.
Fellows Gear Shaper Co.
(Helical Gear Shaper Cutters)
Fitchburg Grinding Mch. Corp.
Gallmeyer & Livingston Co.
Ingersoll Milling Mch. Co.
Landis Tool Co.
LeBlond, R. K., Mch. Tool Co.
Norton Co.
Oliver Instrument Co.
Pratt & Whitney Co.
Thompson Grinder Co.
Union Twist Drill Co.

Worm

Gear Grinding Machine Co.
Jones & Lamson Mch. Co.
Pratt & Whitney Co.

GRINDING WHEELS

Bakelite Corp.
Bay State Abrasive Co.
Besly, Chas. H., & Co.
Blanchard Mch. Co.
Bridgeport Safety Emery Wheel Co., Inc.
Carborundum Co.
Electro Refractories & Alloy Corp.
Norton Co.
Raybestos-Manhattan, Inc., Manhattan-Rubber Div.
Simonds Abrasive Co.
Vitrified Wheel Co.

GROOVING TOOL, INTERNAL

Waldes Kohinoor, Inc.

HAMMERS, Drop

Bliss, E. W., Co.
Chambersburg Engineering Co.
Erie Foundry Co.
Morgan Engineering Co.

Pneumatic

Cleveland Pneumatic Tool Co.
Madison-Kipp Corp.

Power

McKiernan-Terry Corp.
Quickwork-Whiting Div. of Whiting Corp.

Soft

Chambersburg Engineering Co.
S. & H. Soft Hammer Products Co.

Steam

Chambersburg Engineering Co.
Erie Foundry Co.
Sellers, Wm., & Co., Inc.

HANGERS, Shaft

Boston Gear Works, Inc.
Foote Bros. Gear & Machine Corp.
Hill Acme Co.
Sellers, Wm., & Co., Inc.
S K F Industries, Inc.
Standard Pressed Steel Co.

HARDENING EQUIPMENT, Induction

Ohio Chankshaft Co.

HARDNESS TESTING INSTRUMENTS

Shore Instrument & Mfg. Co.
Wilson Mechanical Instrument Co., Inc.

HEADING MACHINES

National Machinery Co.

HEAT TREATMENT OF STEEL

Bennett Metal Treating Co.
Ohio Gear Co.
Perfection Tool & Metal Heat Treating Co.
Pittsburgh Gear Mch. Co.

HOBBING MACHINES

See Gear Cutting Machines, Helical and Spur (Hob), and Gear Cutting Machines, Worm and Worm Wheels.

HOBS

Barber-Colman Co.
Brown & Sharpe Mfg. Co.
Michigan Tool Co.
National Twist Drill & Tool Co.
New Jersey Gear & Mfg. Co.
Union Twist Drill Co.

HOIST HOOKS

American Chain Ladder Co.
Bethlehem Steel Co.
Williams, J. H., & Co.

HOISTING AND CONVEYING MACHINERY

Master Electric Co.
Shepard Niles Crane & Hoist Corp.

HOISTS, Air

Hanna Engineering Works
Ingersoll-Rand Co.

Chain, Etc.

Ryerson, Joseph T., & Son, Inc.
Union Mfg. Co.

Electric

Philadelphia Gear Works
Shepard Niles Crane & Hoist Corp.
Union Mfg. Co.

HONES

Carborundum Co.
General Tool & Die Co.
Micromatic Hone Corp.
Moline Tool Co.
Sunnen Products Co.

HONING MACHINES, Internal (Cylinder)

Barnes Drill Co.
Barnes, W. F. and John, Co.
Micromatic Hone Corp.
Moline Tool Co.
Sunnen Products Co.

HONING MACHINES, External

Barnes Drill Co.
Micromatic Hone Corp.

HOSE, Leather, Rubber, Metallic, Etc.

American Metal Hose Div., American Brass Co.
Cleveland Pneumatic Tool Co.
Raybestos-Manhattan, Inc., Manhattan-Rubber Div.

HYDRAULIC MACHINERY, Tools and Equipment

Baldwin-Southwark Corp.
Barnes, John S., Corp.
Bethlehem Steel Co.
Birdsboro Steel Fdry. & Mch. Co.
Bliss, E. W., Co.
Chambersburg Engineering Co.
Cross Co.
Denison Engineering Co.
Elmes Engineering Works
Farquhar, A. B., Co.
Hannifin Mfg. Co.
Hydraulic Press Mfg. Co.
Hydraulic Products Co.
Hydropress Co., Inc.
Lake Erie Engineering Corp.
Rockford Machine Tool Co.
Sundstrand Mch. Tool Co.
Watson-Stillman Co.

HYDRAULIC POWER UNITS OR TOOL HEADS

Anker-Holth Mfg. Co.
Barnes Drill Co.
Barnes, John S., Corp.
Barnes, W. F. and John, Co.
Ex-Cell-O Corp.
Hannifin Mfg. Co.
Hydraulic Products Co.
National Automatic Tool Co.

HYDRAULIC, Tool Head or Power Unit

Barnes Drill Co.
National Automatic Tool Co.
New Britain-Gridley Mch. Div. New Britain Machine Co.

INDEX CENTERS

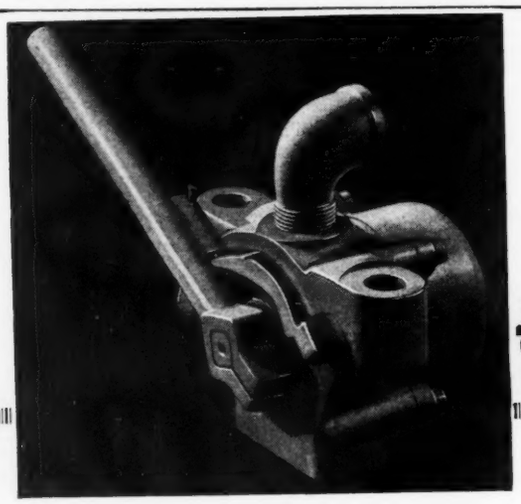
Abrasive Mch. Tool Co.
Brown & Sharpe Mfg. Co.
Kempsmith Mch. Co.
Vinco Corporation

INDEXING and Spacing Fixtures

Grinders & Fixtures, Inc.
Hartford Special Mchry. Co.
Vinco Corporation

INDICATORS, Dial

Ames, B. C., Co.
Brown & Sharpe Mfg. Co.
Federal Products Corp.
Standard Gage Co., Inc.
Starrett, L. S., Co.



NOPAK Manifold Valves are made in 3- and 4-way styles for single and double acting cylinders.

NOPAK Manifold Valves Promote Efficient Operation . . .

Where a number of air cylinders are to be controlled from a single station, NOPAK Manifold Valves permit highly efficient and compact assembly without complicated, unsightly piping. The operator's efficiency is increased, because all valves are mounted within easy reach on a single manifold, with levers aligned in vertical position.

NOPAK Manifold Valves embody the famous NOPAK Cored Disc design, packless construction, easy, positive control, and leakproof, wearproof qualities. Bases are milled flat to provide a flush surface for gaskets if valves are bolted to a manifold plate. Individual pipe nipples may also be screwed into the valve body if the cored holes in the base are tapped out.

GALLAND-HENNING MFG. CO., 2775 31st St., Milwaukee 7, Wis.

NOPAK
VALVES AND CYLINDERS
DESIGNED for AIR and HYDRAULIC SERVICE

A 4976-½I-A

Speed
Bristol Co.
Brown & Sharpe Mfg. Co.
Starrett, L. S., Co.
Veeder-Root, Inc.

Test
Brown & Sharpe Mfg. Co.
Federal Products Corp.
Standard Gage Co., Inc.
Starrett, L. S., Co.

INGOTS, Manganese, Bronze and Brass
Cramp Brass & Iron Foundries Div.

INTENSIFIERS, Hydraulic
Baldwin-Southwark Corp.
Elmes Engineering Works
Farquhar, A. B., Co.
Hydraulic Press Mfg. Co.
Morgan Engineering Co.
Watson-Stillman Co.

JACKS, Planer
Armstrong Bros. Tool Co.

JIG BORER
See Boring Machines, Jig.

JIGS AND FIXTURES
American Measuring Instruments Corp.
American Type Foundries, Inc.
Columbus Die, Tool & Mch. Co.
Ex-Cell-O Corp.
Hartford Special Mchry. Co.
Ingersoll Milling Mch. Co.
Logansport Machine Co., Inc.
Merz Engineering Co.
Sundstrand Mch. Tool Co.
Vinco Corporation
Wade Tool Co.

KEYSEATERS
Baker Bros., Inc.
Consolidated Mch. Tool Corp.
Davis Keyseater Co.
Lapointe Machine Tool Co.

KNURL HOLDERS
Brown & Sharpe Mfg. Co.
Graham Mfg. Co., Inc.
Pratt & Whitney Co.

KNURLING TOOLS
Armstrong Bros. Tool Co.
Graham Mfg. Co., Inc.
Pratt & Whitney Co.
Williams, J. H., & Co.

LAPPING MACHINES
Cincinnati Grinders, Inc.
Ex-Cell-O Corp.
Fellows Gear Shaper Co.
Norton Co.

LATHE ATTACHMENTS
American Tool Wks. Co.
Atlas Press Co.
Bradford Machine & Tool Co.
Gisholt Mch. Co.
Hendey Machine Co.
Jones & Lamson Mch. Co.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Mch. Tool Co.
McCrosky Tool Corp.
Monarch Mch. Tool Co.
Newton Mfg. Co.
Pratt & Whitney Co.
Reed-Prentice Corp.
Rivett Lathe & Grinder, Inc.
Seneca Falls Mch. Co.
South Bend Lathe Wks., Inc.
Springfield Mch. Tool Co.
Stark Tool Co.
Sundstrand Mch. Tool Co.
Wade Tool Co.
Warner & Swasey Co.

LATHE AND GRINDING DOGS
Armstrong Bros. Tool Co.
Williams, J. H., & Co.

LATHES

Automatic
Baird Machine Co.
Cross Co.
Gisholt Mch. Co.
Goss & DeLeeuw Mch. Co.
Jones & Lamson Mch. Co.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Mch. Tool Co.
Monarch Mch. Tool Co.
National Acme Co.
New Britain-Gridley Mch. Div., New Britain Machine Co.
Porter-Cable Machine Co.
Potter & Johnston Mch. Co.
Pratt & Whitney Co.
Reed-Prentice Corp.
Seneca Falls Mch. Co.
Sundstrand Mch. Tool Co.

Axles and Shaft
Consolidated Mch. Tool Corp.
Cross Co.
Lodge & Shipley Mch. Tool Co.
Sellers, Wm., & Co., Inc.
Seneca Falls Mch. Co.
Sundstrand Mch. Tool Co.

Bench
Ames, B. C., Co.
Ames Precision Mch. Wks.
Atlas Press Co.
Elgin Tool Wks., Inc.

INSURANCE POLICY

for *Production*

SUGGESTIONS FOR THE APPLICATION OF
Stuart's ThredKut
CHARACTERISTICS OF OPERATION AND MATERIAL
EACH COLUMN IS IN REFERENCE TO COLUMN ONE ONLY. NOTE ANY CONFLICT. TRY THE MEAN BETWEEN THE TWO
TROUBLE
DECREASE THRED KUT
INCREASE THRED KUT
Tool wear on Front Clearance Short Tool Life Due to Wear on Front Clearance
With kerosene or other very light oil
Copyright 1939, D. A. Stuart Oil Co., Ltd.

** If you haven't a copy of the Thred-Kut Chart, write us—we will gladly send you one, without obligation.*

STUART'S ThredKut Heavy Duty Cutting Oil has played an important part in solving many of industry's toughest metal working problems. Reference to the time-tested ThredKut Chart* has insured the proper application of this versatile product in many production emergencies. Alert production executives will find these aids of great help in answering troublesome metal-working problems. D. A. Stuart Oil Co., Ltd., 2739 S. Troy Street, Chicago 23, Illinois.

D. A. Stuart Oil Co.
LIMITED
ESTABLISHED 1865
Stocks in Principal Metal-Working Centers

Hardinge Brothers, Inc.
LeBlond, R. K., Mch. Tool Co.
Pratt & Whitney Co.
Rivett Lathe & Grinder, Inc.
Seneca Falls Mch. Co.
Sheldon Mch. Co.
South Bend Lathe Wks.
Stark Tool Co.
Wade Tool Co.

Boring

Gisholt Mch. Co.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Mch. Tool Co.

Brass Workers'

Acme Machine Tool Co.
Bardons & Oliver, Inc.
Gisholt Mch. Co.
Seneca Falls Mch. Co.
Springfield Mch. Tool Co.
Warner & Swasey Co.

Crankshaft

Consolidated Mch. Tool Corp.
Cross Co.
LeBlond, R. K., Mch. Tool Co.
Sundstrand Mch. Tool Co.

Double-End

Consolidated Mch. Tool Corp.
Sundstrand Mch. Tool Co.

Engine and Toolroom

Acme Machine Tool Co.
American Tool Wks. Co.
Atlas Press Co.
Axelson Manufacturing Co.
Bradford Machine Tool Co.
Consolidated Mch. Tool Corp.
Hendey Machine Co.
LeBlond, R. K., Mch. Tool Co.
Lehmann Machine Co.
Lodge & Shipley Mch. Tool Co.
Logan Engineering Co.
Mackintosh & Hemphill Co.
Monarch Mch. Tool Co.
Morey Machinery Co., Inc.
Pratt & Whitney Co.
Reed-Prentice Corp.
Rivett Lathe & Grinder, Inc.
Seneca Falls Mch. Co.
Sheldon Mch. Co.
Sidney Machine Tool Co.
Simmonds Machine Tool Corp.
South Bend Lathe Wks.
Springfield Mch. Tool Co.

Extension Bed and Gap

Gisholt Mch. Co.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Mch. Tool Co.
Seneca Falls Mch. Co.
South Bend Lathe Wks.
Warner & Swasey Co.

Gun

Consolidated Mch. Tool Corp.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Mch. Tool Co.
Seneca Falls Mch. Co.
Springfield Mch. Tool Co.

Manufacturing Type

Lipe-Rollway Corporation
Lodge & Shipley Mch. Tool Co.

Spinning

See Chucking Machines.

Toolroom

See Lathes, Engine and Toolroom.

Turret

Acme Machine Tool Co.
Bardons & Oliver, Inc.
Brown & Sharpe Mfg. Co.
Bullard Company
Foster Div., International Detrola Corp.
Gisholt Mch. Co.
Hardinge Brothers, Inc.
(Bench or Cabinet Mounting)
Jones & Lamson Mch. Co.
LeBlond, R. K., Mch. Tool Co.
Morey Machinery Co.
National Acme Co.
Oster Mfg. Co.
Potter & Johnston Mch. Co.
Production Machine Co.
Rivett Lathe & Grinder, Inc.
Simmons Machine Tool Corp.
South Bend Lathe Wks., Inc.
Springfield Mch. Tool Co.
Stark Tool Co.
Wade Tool Co.
Warner & Swasey Co.

Turret Automatic

Potter & Johnston Mch. Co.

Vertical Turret

Bullard Company
Rogers Machine Works, Inc.

LEVELS

Pratt & Whitney Co.
Starrett, L. S., Co.
Universal Boring Mch. Co.

LUBRICANTS, Including Extreme Pressure (EP) Machinery Lubricants

Cities Service Oil Co.
Gulf Oil Corp.
Shell Oil Co., Inc.
Sinclair Refining Co.
Socony Vacuum Oil Co., Inc.
Standard Oil Co. (Indiana)
Stuart, D. A., Oil Co., Ltd.
Sun Oil Co.
Texas Co.
Tide Water Associated Oil Co.

LUBRICATING SYSTEMS

Madison-Kipp Corp.
Rivett Lathe & Grinder, Inc.

MACHINISTS' SMALL TOOLS

See Calipers, Hammers, Wrenches, Drills, Taps, Etc.

MAGNESIUM

Dow Chemical Co.

MANDRELS

See Arbors and Mandrels.

MARKING MACHINES AND DEVICES

Colonial Broach Co.
Ideal Industries, Inc.
Noble & Westbrook Mfg. Co.

MEASURING MACHINES AND INSTRUMENTS, PRECISION

Federal Products Corp.
Hanson-Whitney Mch. Co.
Norma-Hoffmann Bearings Corp.
Pratt & Whitney Co.
Scherr, George, Co., Inc.
Van Keuren Co.
Vinco Corporation

MEASURING WIRES, Thread, Spline and Gear

Van Keuren Co.

METALS, Bearing

See Bearings, Bronze, Babbitt, Etc. and Bushings, Brass, Bronze, Etc.

METALS, Perforated

Chicago Perforating Co.

METERS

See Recording Instruments.

MICROMETERS

Bath, John, & Co., Inc.
Brown & Sharpe Mfg. Co.
Davis & Thompson Co.
Pratt & Whitney Co.
Scherr, George, Co., Inc.
Starrett, L. S., Co.
Van Keuren Co.

MICROSCOPES, Toolmakers

Scherr, George, Co., Inc.

MILLING ATTACHMENTS

Brown & Sharpe Mfg. Co.
Cincinnati Milling Machine Co.
Consolidated Mch. Tool Corp.
Elgin Tool Wks., Inc.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Kempsmith Mch. Co.
Porter-Cable Machine Co.
Reed-Prentice Corp.
Rivett Lathe & Grinder, Inc.
Sundstrand Mch. Tool Co.
Van Norman Co.

MILLING MACHINES

Automatic

Cincinnati Milling Machine Co.
Consolidated Mch. Tool Corp.
Cross Co.
Ingersoll Milling Mch. Co.
Jones & Lamson Mch. Co.
Kearney & Trecker Corp.
Sundstrand Mch. Tool Co.
U. S. Tool Company, Inc.

Bench

Ames, B. C., Co.
Atlas Press Co.
Burke Machine Tool Co.
Hardinge Brothers, Inc.
(Bench or Pedestal Type)
Pratt & Whitney Tool Co.
Stark Tool Co.

Circular Continuous

Consolidated Mch. Tool Corp.
Cross Co.
Davis & Thompson Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Sundstrand Mch. Tool Co.

Die Sinking

See Die Sinking Machines.

Duplex

Cincinnati Milling Machine Co.
Consolidated Mch. Tool Corp.
Cross Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Taylor & Fenn Co.

Hand

Burke Machine Tool Co.
Frew Machine Co.
Nichols, W. H., & Sons
Sundstrand Mch. Tool Co.
Van Norman Co.

Horizontal, Plain and Universal

Brown & Sharpe Mfg. Co.
Cincinnati Milling Machine Co.
Consolidated Mch. Tool Corp.
Cross Co.
DoAll Co.
Frew Machine Co.
Gorton, George, Mch. Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Kempsmith Mch. Co.
Machinery Mfg. Co.
Ohio Machine Tool Co.
Producto Machine Co.
Sidney Machine Tool Co.
Simmons Machine Tool Corp.
Sundstrand Mch. Tool Co.
Van Norman Mch. Tool Co.

Lincoln Type

Brown & Sharpe Mfg. Co.
Sundstrand Mch. Tool Co.

Planer Type

Cincinnati Planer Co.
Consolidated Mch. Tool Corp.
Davis & Thompson Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Sellers, Wm., & Co., Inc.
Stokerunit Corp.

Planetary

Cross Gear & Machinery Co.

Ram Type, Universal

Van Norman Co.

Vertical

Brown & Sharpe Mfg. Co.
Cincinnati Milling Machine Co.
Consolidated Mch. Tool Corp.
Cross Co.
DoAll Co.
Gorton, George, Mch. Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Machinery Mfg. Co.
Pratt & Whitney Co.
Reed-Prentice Corp.
Sidney Machine Tool Co.
Sundstrand Mch. Tool Co.
Taylor & Fenn Co.

MODEL AND EXPERIMENTAL WORK

See Special Machinery Tools.

MOLD AND DIE COPYING MACHINES

Gorton, George, Mch. Co.

MOLDING MACHINES, Plastic Products

Hydraulic Press Mfg. Co.
Reed-Prentice Corp.
Watson-Stillman Co.

MOLYBDENUM

Climax Molybdenum

MOTORS, Electric

Dumore Co.
General Electric Co.
Lincoln Electric Co.
Master Electric Co.
Reliance Electric & Engrg. Co.
Star Electric Motor Co.
Westinghouse Electric Corp.

MOUNTINGS, RUBBER, JOINTS AND COUPLINGS

Lord Manufacturing Co.
Raybestos-Manhattan, Inc., Manhattan Rubber Div.

MULTIPLE-SLIDE FORMING MACHINES

Baird Machine Co.
U. S. Tool Co., Inc.

NAME PLATES

Noble & Westbrook Mfg. Co.

NIBBLING MACHINES

Campbell, Andrew C., Div., American Chain & Cable Co., Inc.
Gray Machine Co,

NICKEL

International Nickel Co.

NIPPLE THREADING MACHINERY

Landis Mch. Co., Inc.
Oster Manufacturing Co.

NUMBERING MACHINES

Noble & Westbrook Mfg. Co.

NUT MAKING MACHINERY

National Machinery Co.

NUT SETTING EQUIPMENT

See Screw Driving and Nut Setting Equipment.

NUT TAPPERS

See Bolt and Nut Machinery.

NUTS, Cold Forged, Wing and Cap

Parker-Kalon Corp.
Republic Steel Corp.
(Union Drawn Steel Div.)

NUTS, Self-Locking

Elastic Stop Nut Corp. of America

NUTS, Thumb or Wing and Cap

Republic Steel Corp.
(Union Drawn Steel Div.)
Williams, J. H., & Co.

OIL CAPS

Besly, Chas. H., & Co.
Gits Bros. Mfg. Co.
Trico Fuse Mfg. Co.

OIL EXTRACTORS

DeLaval Separator Co.

OIL GROOVERS

Hanson-Whitney Mch. Co.

OIL HOLE COVERS

Gits Bros. Mfg. Co.

OILERS AND LUBRICATORS

Gits Bros. Mfg. Co.
Madison-Kipp Corp.
Trico Fuse Mfg. Co.

OILS, Cutting

Cimcool Div., Cincinnati Milling Machine Co.
Cities Service Oil Co.
Gulf Oil Corp.
Shell Oil Co., Inc.
Stuart, D. A., Oil Co., Ltd.
Sun Oil Co.
Texas Co.
Tide Water Associated Oil Co.

Lubricating

Besly, Chas. H., & Co.
Cities Service Oil Co.
Gulf Oil Corp.
Shell Oil Co., Inc.
Sinclair Refining Co.
Socony Vacuum Oil Co., Inc.
Standard Oil Co. (Indiana)
Stuart, D. A., Oil Co., Ltd.
Sun Oil Co.
Texas Co.
Tide Water Associated Oil Co.

Quenching and Tempering

Cities Service Oil Co.
Gulf Oil Corp.
Shell Oil Co., Inc.
Standard Oil Co. (Indiana)
Stuart, D. A., Oil Co., Ltd.

Soluble

See Compounds, Cutting, Grinding, Metal Drawings, Etc.

ORDNANCE MACHINES, Special

Rehnberg-Jacobson Mfg. Co.

PACKING, Leather, Metal, Rubber, Asbestos, Etc.

Garlock Packing Co.
Raybestos-Manhattan, Inc., Manhattan Rubber Div.
Watson-Stillman Co.

PARALLELS

Brown & Sharpe Mfg. Co.
Johansson Div., Ford Motor Co.
Starrett, L. S., Co.
Taft-Peirce Mfg. Co.
Walker, O. S., Co., Inc.

PATTERNS, WOOD

Mummert-Dixon Co.

PHOSPHOR BRONZE—See Bronze.

PILLOW BLOCKS

Norma-Hoffmann Bearings Corp.
S K F Industries, Inc.
Standard Pressed Steel Co.

PIPE, BRASS AND COPPER

American Brass Co.

PIPE CUTTING AND THREADING MACHINES

Foote-Burt Co.
Landis Mch. Co., Inc.
Oster Manufactuirng Co.

PIPE JOINTS, SWIVEL

Chicksan Co.

PIPE, STEEL

Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Jones & Laughlin Steel Corp.
National Tube Co.
(U. S. Steel Corp. Div.)
Republic Steel Corp.
(Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.

PIPE TONGS

Williams, J. H., & Co.

PLANER ATTACHMENTS

Cincinnati Planer Co.
Consolidated Mch. Tool Co.
Hanson-Whitney Mch. Co.
Rockford Machine Tool Co.

PLANERS

Baldwin-Southwark Corp.
Cincinnati Planer Co.
Consolidated Mch. Tool Corp.
(Incl. Plate, Rotary and Crank Types)
Ohio Machine Tool Co.
Rockford Machine Tool Co.
Sellers, Wm., & Co., Inc.

Openside

Cincinnati Planer Co.
Rockford Machine Tool Co.

PLASTICS and Plastic Products
Bakelite Corp.
Durez Plastics & Chemicals, Inc.

PLATE ROLLS
Baldwin-Southwark Corp.
Bethlehem Steel Co.
Cleveland Punch & Shear Wks. Co.
Consolidated Mch. Tool Corp.
Hannifin Mfg. Co.
Ryerson, Joseph T., & Son, Inc.

PLATES, Surface
Brown & Sharpe Mfg. Co.
Challenge Machinery Co.
Ideal Industries, Inc.
Jones Machine Tool Wks., Inc
Rotor Tool Co.
Scherr, George, Co., Inc.
Taft-Peirce Mfg. Co.
U. S. Tool Company, Inc.
Vinco Corporation

PNEUMATIC EQUIPMENT
Anker-Holth Mfg. Co.
Bliss, E. W., Co.
Hanna Engineering Works
Hannifin Mfg. Co.
Ingersoll-Rand Co.
Logansport Machine Co., Inc.

POLISHING LATHES and Machines
Besly, Chas. H., & Co.
Bridgeport Safety Emery Wheel Co., Inc.
DoAll Co.
Gardner Machine Co.
Production Mch. Co.
Sundstrand Mch. Tool Co.

POLISHING TOOLS, Portable
Stow Mfg. Co.
Strand, N. A., & Co.

PRESSES

Arbor
Baldwin-Southwark Corp.
Dake Engine Co.
Elmes Engineering Works
Famco Machine Co.
Farquhar, A. B., Co.
General Manufacturing Co.
Hannifin Mfg. Co.
Lempco Products, Inc.
Logansport Machine Co., Inc.
Sheldon Mch. Co.
Watson-Stillman Co.
Wilson, K. R.

Broaching
American Broach & Mch. Co.
Bliss, E. W., Co.
General Manufacturing Co.
Lapointe Machine Tool Co.
Peck, Stow & Wilcox Co.
V & O Press Co.
Watson-Stillman Co.

Extrusion
Hydraulic Press Mfg. Co.
Hydropress Co., Inc.
Lake Erie Engineering Corp.
National Machinery Co.
Watson-Stillman Co.

Foot
Baird Machine Co.
Bliss, E. W., Co.
Etna Machine Co.
Famco Machine Co.
Niagara Machine & Tool Wks.
Peck, Stow & Wilcox Co.
Taylor & Fenn Co.
V & Press Co.

Forging
Ajax Manufacturing Co.
Baldwin-Southwark Corp.
Bethlehem Steel Co.
Bliss, E. W., Co.
Clearing Mch. Co.
Cleveland Punch & Shear Works Co.
Erie Foundry Co.
Farquhar, A. B., Co.
Henry & Wright Mfg. Co.
Hydraulic Press Mfg. Co.
Hydropress Co., Inc.
Lake Erie Engineering Corp.
Morgan Engineering Co.
National Machinery Co.
Niagara Machine & Tool Wks.
Peck, Stow & Wilcox Co.
Verson Allsteel Press Co.
V & O Press Co.
Watson-Stillman Co.
Zeh & Hahnemann Co.

Hydraulic
American Broach & Mch. Co.
Baldwin-Southwark Corp.
Bethlehem Steel Co.
Birdsboro Steel Fdry. & Mch. Co.
Bliss, E. W., Co.
Clearing Mch. Co.
Colonial Broach Co.
Dake Engine Co.
Denison Engineering Co.
Elmes Engineering Works
Erie Foundry Co.
Farrel-Birmingham Co., Inc.
Farquhar, A. B., Co.
Hannifin Mfg. Co.
Hydraulic Press Mfg. Co.
Hydropress Co., Inc.
Lake Erie Engineering Co.
Lapointe Machine Tool Co.
Morgan Engineering Co.
Verson Allsteel Press Co.
Watson-Stillman Co.
Wilson, K. R.

Percussion
Wilson, K. R.

Screw
Bliss, E. W., Co.
General Manufacturing Co.
Niagara Machine & Tool Wks.
Zeh & Hahnemann Co.

Sheet Metal Working
Baldwin-Southwark Corp.
Bliss, E. W., Co.
Cincinnati Shaper Co.
Clearing Mch. Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. & Tool Corp.
Famco Machine Co.
Farquhar, A. B., Co.
Henry & Wright Mfg. Co.
Hydraulic Press Mfg. Co.
L & J Press Corp.
Lake Erie Engineering Corp.
Niagara Machine & Tool Wks.
Peck, Stow & Wilcox Co.
Quickwork-Whiting Div. of Whiting Corp.
Steelweld Mchry. Div. of Cleveland Crane & Engrg. Co.
Verson Allsteel Press Co.
V & O Press Co.
Watson-Stillman Co.
Zeh & Hahnemann Co.

Straightening
Baldwin-Southwark Corp.
Colonial Broach Co.
Consolidated Mch. Tool Corp.
Elmes Engineering Works
Farquhar, A. B., Co.
General Manufacturing Co.
Hannifin Mfg. Co.
Hydraulic Press Mfg. Co.
Jones Machine Tool Wks., Inc.
Lempco Products, Inc.
Morgan Engineering Co.
Springfield Mch. Tool Co.
Watson-Stillman Co.

PRINT PAPER, BLUE, WHITE, ETC.
Ozalid Products Div. General Aniline & Film Corp.

PROFILING MACHINES
Consolidated Mch. Tool Corp.
Frew Machine Co.
Gorton, George, Mch. Co.
Leland-Gifford Co.
Morey Machinery Co., Inc.
Pratt & Whitney Co.
Reed-Prentice Corp.
Wade Tool Co.

PULLEYS
Boston Gear Works, Inc.
DoAll Co.
Foote Bros. Gear & Machine Corp.
Hill Acme Co.
Sellers, Wm., & Co., Inc.

Friction Clutch
Brown & Sharpe Mfg. Co.

PUMPS, Coolant, Lubricant and Oil
Brown & Sharpe Mfg. Co.
DeLaval Steam Turbine Co.
Ingersoll-Rand Co.
Logansport Machine Co., Inc.
Ruthman Machinery Co.
Tuthill Pump Co.
Viking Pump Co.

Hydraulic
Baldwin-Southwark Corp.
Barnes, John S., Corp.
Bethlehem Steel Co.
Brown & Sharpe Mfg. Co.
DeLaval Steam Turbine Co.
Elmes Engineering Works
Hydropress Co., Inc.
Ingersoll-Rand Co.
Lapointe Machine Tool Co.
McIntyre Co.
Sundstrand Mch. Tool Co.
Tuthill Pump Co.
Viking Pump Co.
Watson-Stillman Co.

Pneumatic
Ingersoll-Rand Co.

Rotary
Brown & Sharpe Mfg. Co.
DeLaval Steam Turbine Co.
Tuthill Pump Co.
Viking Pump Co.

PUNCHES AND DIES
See Dies, Sheet Metal, Inc.

PUNCHES, CENTERING
Cleveland Punch & Shear Works Co.

PUNCHING MACHINERY
Buffalo Forge Co.
Cincinnati Shaper Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. Tool Corp.
Hannifin Mfg. Co.
Niagara Machine & Tool Wks.
Peck, Stow & Wilcox Co.
Ryerson, Joseph T., & Son, Inc.
Steelweld Mchry. Div. of Cleveland Crane & Engrg. Co.
Watson-Stillman Co.

PUNCHING AND RIVETING MACHINES
Hannifin Mfg. Co.

PYROMETERS
Bristol Co.
Leeds & Northrup Co.
Shore Instrument & Mfg. Co.

RACK CUTTING MACHINES AND ATTACHMENTS
Gould & Eberhardt

RACKS, GEAR, CUT
Atlantic Gear Works, Inc.
Boston Gear Works, Inc.
Brown & Sharpe Mfg. Co.
Fellows Gear Shaper Co.
Foote Bros. Gear & Machine Corp.
Hartford Special Mchry. Co.
Massachusetts Gear & Tool Co.
Meisel Press Mfg. Co.
Philadelphia Gear Works
Stahl Gear & Machine Co.

REAMER HOLDERS
Gairing Tool Co.
Gisholt Machine Co.
Landis Mch. Co., Inc.
Lipe-Rollway Corporation
McCrosky Tool Corp.
Scully-Jones & Co.
Warner & Swasey Co.

REAMERS
Barber-Colman Co.
Butterfield Div., Union Twist Drill Co.
Carboloy Co., Inc.
Cleveland Twist Drill Co.
Columbus Die, Tool & Mch. Co.
Ex-Cell-O Corporation
Firth-Sterling Steel Co.
Gairing Tool Co.
Gammons-Hoaglund Co.
Genesee Tool Co.
Gisholt Machine Co.
Greenfield Tap & Die Corp.
Haynes Stellite Co.
Illinois Tool Wks.
Lipe-Rollway Corporation
McCrosky Tool Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Scully-Jones & Co.
Standard Tool Co.
Super Tool Co.
Tungsten Carbide Tool Co.
Union Twist Drill Co.

Adjustable
Barber-Colman Co.
Carboloy Co., Inc.
Cleveland Twist Drill Co.
Ex-Cell-O Corporation
Firth Sterling Steel Co.
Gairing Tool Co.
Gisholt Machine Co.
Greenfield Tap & Die Corp.
McCrosky Tool Corp.
Morse Twist Drill & Mch. Co.
Pratt & Whitney Co.
Rogers, John M., Tool Corp.
Standard Tool Co.
Taft-Peirce Mfg. Co.
Union Twist Drill Co.

Taper Pin
Butterfield Div., Union Twist Drill Co.
Gammons-Hoaglund Co.
Greenfield Tap & Die Corp.
Lipe-Rollway Corporation
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Standard Tool Co.
Union Twist Drill Co.

REAMING MACHINES
Van Norman Co.

RECORDING INSTRUMENTS

For Counting
National Acme Co.

For Electricity
Bristol Co.
General Electric Co.
Leeds & Northrup Co.

For Pressure
Bristol Co.
Leeds & Northrup Co.

For Speed
Bristol Co.
Leeds & Northrup Co.

For Temperature
Bristol Co.
Leeds & Northrup Co.

REELS, Stock, Standard and Automatic
S & S Mch. Wks.
U. S. Tool Company, Inc.

REFRACTORIES, Heat Treating Furnace
Norton Co.

REGULATORS, Temperature
Bristol Co.
General Electric Co.
Leeds & Northrup Co.

REMOVERS, Japan, Enamel, Etc.
Oakite Products, Inc.

RETAINING RINGS FOR BEARINGS, ETC.
Waldes Kohinoor, Inc.

RHEOSTATS
Allen-Bradley Co.
General Electric Co.

RIVET SETS
Bethlehem Steel Co.
Cleveland Pneumatic Tool Co.
Cleveland Punch & Shear Works Co.

RIVETERS, Hydraulic
Bethlehem Steel Co.
Hanna Engineering Works
Hannifin Mfg. Co.
Hydraulic Press Mfg. Co.
Morgan Engineering Co.

Pneumatic
Cleveland Pneumatic Tool Co.
Grant Mfg. & Mch. Co.
Hanna Engineering Works
Hannifin Mfg. Co.
Ingersoll-Rand Co.
Ryerson, Joseph T., & Son, Inc.

RIVETING MACHINES
Buffalo Forge Co.
General Riveters, Inc.
Grant Mfg. & Mch. Co.
Hanna Engineering Works
Hannifin Mfg. Co.
Peck, Stow & Wilcox Co.
Producto Machine Co.

RIVET MAKING MACHINES
Hill Acme Co.
National Machinery Co.

RIVETS
Republic Steel Corp., (Union Drawn Steel Div.)

RUBBER PRODUCTS
Raybestos-Manhattan, Inc., Manhattan Rubber Div.

RULES, Steel
Brown & Sharpe Mfg. Co.
Scherr, George, Co., Inc.
Starrett, L. S., Co.

RUST PREVENTATIVE
National Oil Products Co.
Oakite Products, Inc.
Scherr, George, Co., Inc.

SAND BLAST EQUIPMENT
See Blast Cleaning Equipment

SANDERS
Carborundum Co.
Delta Manufacturing Co.
Ingersoll-Rand Co.
Porter-Cable Machine Co.
Rotor Tool Co.
Sand-O-Flex Corp.
Sundstrand Mch. Tool Co.
Walls Sales Corp.

SAW BLADES, HACK
Armstrong-Blum Mfg. Co.
Simonds Saw & Steel Co.
Starrett, L. S., Co.

SAW SHARPENING MACHINES
Earle Gear & Mch. Co.
Huther Bros. Saw Mfg. Co., Inc.
Scherr, George, Co., Inc.

SAWING MACHINES

Circular
Consolidated Mch. Tool Corp.
Earle Gear & Mch. Co.
Etna Machine Co.

Friction
Ryerson, Joseph T., & Son, Inc.

Metal Cutting Band
Armstrong-Blum Mfg. Co.
Avey Drilling Machine Co.
Delta Manufacturing Co.
DoAll Co.
Grob Brothers
Huther Bros. Saw Mfg. Co., Inc.
Ryerson, Joseph T., & Son, Inc.
Simonds Saw & Steel Co.

Power Hack
Armstrong-Blum Mfg. Co.
Ryerson, Joseph T., & Son, Inc.

SAWS, Circular Metal Cutting
Brown & Sharpe Mfg. Co.
Consolidated Mch. Tool Corp.
Espen-Lucas Machine Works
Genesee Tool Co.
Huther Bros. Saw Mfg. Co., Inc.
Illinois Tool Wks.
National Twist Drill & Tool Co.
Simonds Saw & Steel Co.
Standard Tool Co.
Union Twist Drill Co.
Walker-Turner Co., Inc.

Metal Cutting Band
Armstrong-Blum Mfg. Co.
Delta Mfg. Co.
DoAll Co., Inc.
Huther Bros. Saw Mfg. Co., Inc.
Ryerson, Joseph T., & Son, Inc.
Starrett, L. S., Co.
Tannewitz Works
Walker-Turner Co., Inc.
Wells Manufacturing Corp.

TAPPING TIPS*

From Woody Spencer's Notebook

A DULL TAP'S LIKE A DULL RAZOR— ONLY WORSE

Started shavin' the other day without makin' sure I had a new, keen blade. Figured I could "get by". Well, the scratch and drag I got served me right. It didn't cost me any money but it started me thinkin'. Tryin' to "get by" with a dull tap won't hurt your face any but it sure will hurt the pocket book. A tap that's dull runs hard, gets hot, binds, tears threads and lots of times it breaks and you lose the tap altogether. Taps are edged, cutting tools. They should be kept sharpened, not only the chamfer but in the flutes, too.

That way you make sure of faster production, cleaner holes and smooth, uniform threads. And you sidestep all the troubles a dull tap can cause.

These Tapping Tips of Woody's are not intended as technical advice nor are they any cure-all for tapping troubles. They are just plain short cuts, hints and horse sense suggestions that Woody has picked up from the boys in the shops and wants to pass along for what they're worth. He just wants them to save a little time or make a job run smoother and quicker.

For the specific technical problems that come up with so many tapping jobs, we suggest definite engineering advice. Send the complete data on a job, material, depth, diameter, type of hole, lubricant, etc., and our engineers will be glad to make suggestions. No obligation, of course.

Woody Spencer's new Handy Tap Guide is full of information that will make tapping jobs easier and smoother. It's in convenient size for tool crib, shop or engineer's desk. And it's FREE. Write for your copy on your company letterhead.

*NOTE: These Tapping Tips are appearing here as often as Woody gets time to write them up. Look for them.

THE RIGHT TAP AT THE RIGHT TIME

The Wood & Spencer Company
Cleveland 3, Ohio

Screw Slotting
Barber-Colman Co.
Brown & Sharpe Mfg. Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Simonds Saw & Steel Co.
Standard Tool Co.
Starrett, L. S., & Co.
Union Twist Drill Co.

SCRAPERS, Hand & Power
Anderson Bros. Mfg. Co.

SCREW DRIVING AND NUT SETTING EQUIPMENT
Errington Mechanical Laboratory
Haskins, R. G., Co.
Ingersoll-Rand Co.
Procunier Safety Chuck Co.
Strand, N. A., & Co.

SCREW MACHINES, Automatic, Single and Multiple Spindle
Brown & Sharpe Mfg. Co.
Cleveland Automatic Machine Co.
Cone Automatic Machine Co., Inc.
Foote-Burt Co.
Greenlee Bros. & Co.
National Acme Co.
New Britain-Gridley Mch. Div., New Britain Machine Co.
Scherr, George, Co., Inc.
Triplex Machine Tool Corp.

SCREW MACHINES, Hand
See also Lathes, Turret.
Acme Machine Tool Co.
Bardons & Oliver, Inc.
Brown & Sharpe Mfg. Co.
Gisholt Mch. Co.
Hardinge Brothers, Inc.
Jones & Lamson Machine Co.
Rivett Lathe & Grinder, Inc.
Simmons Machine Tool Corp.
Stark Tool Co.
Wade Tool Co.
Warner & Swasey Co.

SCREW MACHINE TOOLS AND EQUIPMENT
Bardons & Oliver, Inc.
Brown & Sharpe Mfg. Co.
Cleveland Automatic Machine Co.
Gisholt Mch. Co.
Greenlee Bros. & Co.
Jones & Lamson Machine Co.
Landis Mch. Co., Inc.
National Acme Co.
New Britain-Gridley Mch. Div., New Britain Machine Co.
Potter & Johnston Machine Co.
R and L Tools
Warner & Swasey Co.

SCREW MACHINE WORK
Aluminum Co. of America
Eastern Mch. Screw Corp.
Morse Twist Drill & Mch. Co.
National Acme Co.
Standard Pressed Steel Co.

SCREW PLATES
Besly, Chas. H., & Co.
Butterfield Div., Union Twist Drill Co.
Card, S. W., Mfg. Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
Pratt & Whitney Co.

SCREWS
Cap, Set, Safety Set and Machine
Allen Mfg. Co.
American Hardware Co.
American Screw Co.
Atlas Bolt Screw Co.
Bristol Co.
Central Screw Co.
Chandler Products Corp.
Continental Screw Co.
Corbin Screw Co.
Elco Tool & Screw Corp.
General Screw Mfg. Co.
Harper, H. M., & Co.
Holo-Krome Screw Corp.
International Screw Co.
Lamson & Sessions Co.
Milford Rivet & Machine Co.
National Acme Co.
National Lock Co.
National Screw & Mfg. Co.
New England Screw Co.
Parker, Chas., Co.
Parker-Kalon Corp.
Pawtucket Screw Co.
Pheoll Mfg. Co.
Reading Screw Co.
Republic Steel Corp. (Union Drawn Steel Div.)
Russell, Burdsall & Ward Bolt & Nut Co.
Scovill Mfg. Co.
Southington Hardware Co.
Standard Pressed Steel Co.
Steel Co. of Canada, Ltd.
Sterling Bolt Co.
Whitney Screw Corp.
Wolverine Belt Co.

SCREWS, Self-Tapping Drive
Parker-Kalon Corp.

SCREWS, Thumb
American Screw Co.
Parker-Kalon Corp.
Williams, J. H., & Co.

SEALS AND RETAINERS
Oil or Grease
Garlock Packing Co.
Gits Bros. Mfg. Co.

SEAMLESS STEEL TUBING
See Tubing, Seamless Steel.

SECOND HAND MACHINERY, Etc.
Cincinnati Machinery & Supply Co.
Eastern Machinery Co.
Miles Machinery Co.
Morey Mchry. Co., Inc.
Simmons Machine Tool Corp.

SEPARATORS, CENTRIFUGAL
DeLaval Separator Co.

SEPARATORS, Oil or Coolant
Barnes Drill Co.
National Acme Co.

SHAFTING, STEEL
Bethlehem Steel Co.
Commercial Forgings Co.
Cumberland Steel Co.
Jones & Laughlin Steel Corp.
National Tube Co.
(U. S. Steel Corp., Div.)
Ryerson, Joseph T., & Son, Inc.
Standard Pressed Steel Co.

SHAFTS
Flexible
Haskins, R. G., Co.
Stewart, F. W., Mfg. Co.
Strand, N. A., & Co.

Hollow Bored
American Hollow Boring Co.
Bethlehem Steel Co.

Turned and Ground
Bethlehem Steel Co.
Cumberland Steel Co.
Jones & Laughlin Steel Corp.
Ryerson, Joseph T., & Son, Inc.

SHAPERS
American Tool Works Co.
Atlas Press Co.
Cincinnati Shaper Co.
General Engrg. & Mfg. Co.
Hendey Machine Co.
Machinery Mfg. Co.
Ohio Machine Tool Co.
Rockford Mch. Tool Co.
Smith & Mills Co.

Vertical
Hanson-Whitney Mfg. Co.
Jones Machine Tool Wks., Inc.
Pratt & Whitney Co.
Rhodes Manufacturing Co.
Rockford Machine Tool Co.

SHAPES, Structural
Aluminum Co. of America
Bethlehem Steel Co.
Cramp Brass & Iron Foundries Div.
Jones & Laughlin Steel Corp.

SHEARING MACHINERY
Bethlehem Steel Co.
Buffalo Forge Co.
Cincinnati Shaper Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. Tool Corp.
Hannifin Mfg. Co.
Hydropress Co., Inc.
Morgan Engineering Co.
Niagara Mch. & Tool Wks.
O'Neil-Irwin Mfg. Co.
Peck, Stow & Wilcox Co.
Quickwork-Whiting Div. of Whiting Corp.
Ryerson, Joseph T., & Son, Inc.
Watson-Stillman Co.
Yoder Co.

SHEARS, Alligator
Hill Acme Co.

SHEARS
Rotary
Bliss, E. W., Co.
Brown & Sharpe Mfg. Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. Tool Corp.
Niagara Mch. & Tool Wks.
Peck, Stow & Wilcox Co.
Quickwork-Whiting Div. of Whiting Corp.
Ryerson, Joseph T., & Son, Inc.
Union Twist Drill Co.

Squaring
Cincinnati Shaper Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. Tool Corp.
Niagara Mch. & Tool Wks.
Peck, Stow & Wilcox Co.

SHEET METALS
Aluminum Co. of America
American Brass Co.
Associated Metals
Bethlehem Steel Co.
Ryerson, Joseph T., & Son, Inc.

SHEETS, Iron & Steel
Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Jones & Laughlin Steel Corp.
Republic Steel Corp.
(Union Drawn Steel Div.)
Ryerson, Joseph T., & Son, Inc.

Perforated
Chicago Perforating Co.

SINE BARS
Johansson Div., Ford Motor Co.
Starrett, L. S., Co.
Vinco Corporation

SLEEVES
Cleveland Twist Drill Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Scully-Jones & Co.
Standard Tool Co.
Union Twist Drill Co.

SLOTTING MACHINES
Baker Brothers, Inc.
Consolidated Mch. Tool Corp.
Jones Machine Tool Wks., Inc.
Rockford Mch. Tool Co.
Sellers, Wm., & Co., Inc.

SOCKETS
Cleveland Twist Drill Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney Co.
Scully-Jones & Co.
Standard Tool Co.
Union Twist Drill Co.
Williams, J. H., & Co.

SOLDER FOR ALUMINUM AND CAST IRON
Cramp Brass & Iron Foundries Div.

SPECIAL MACHINERY AND TOOLS
American Type Foundries, Inc.
Baird Machine Co.
Baldwin-Southwark Corp.
Barnes Drill Co.
Barnes, W. F. & John, Co.
Baush Machine Tool Co.
Bethlehem Steel Co.
Bilgram Gear & Mch. Wks.
Birdsboro Steel Fdy. & Mch. Co.
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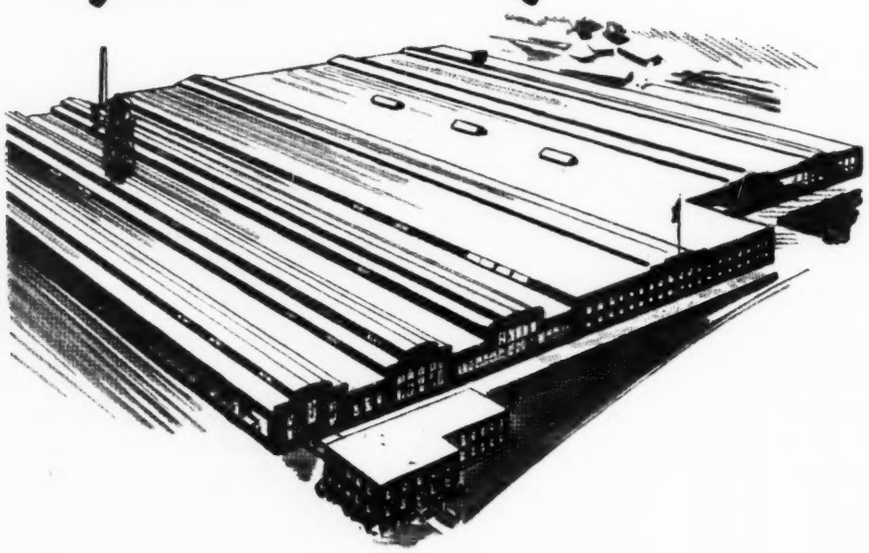

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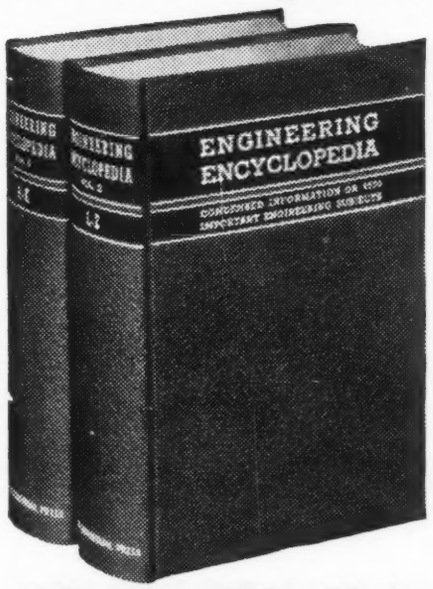

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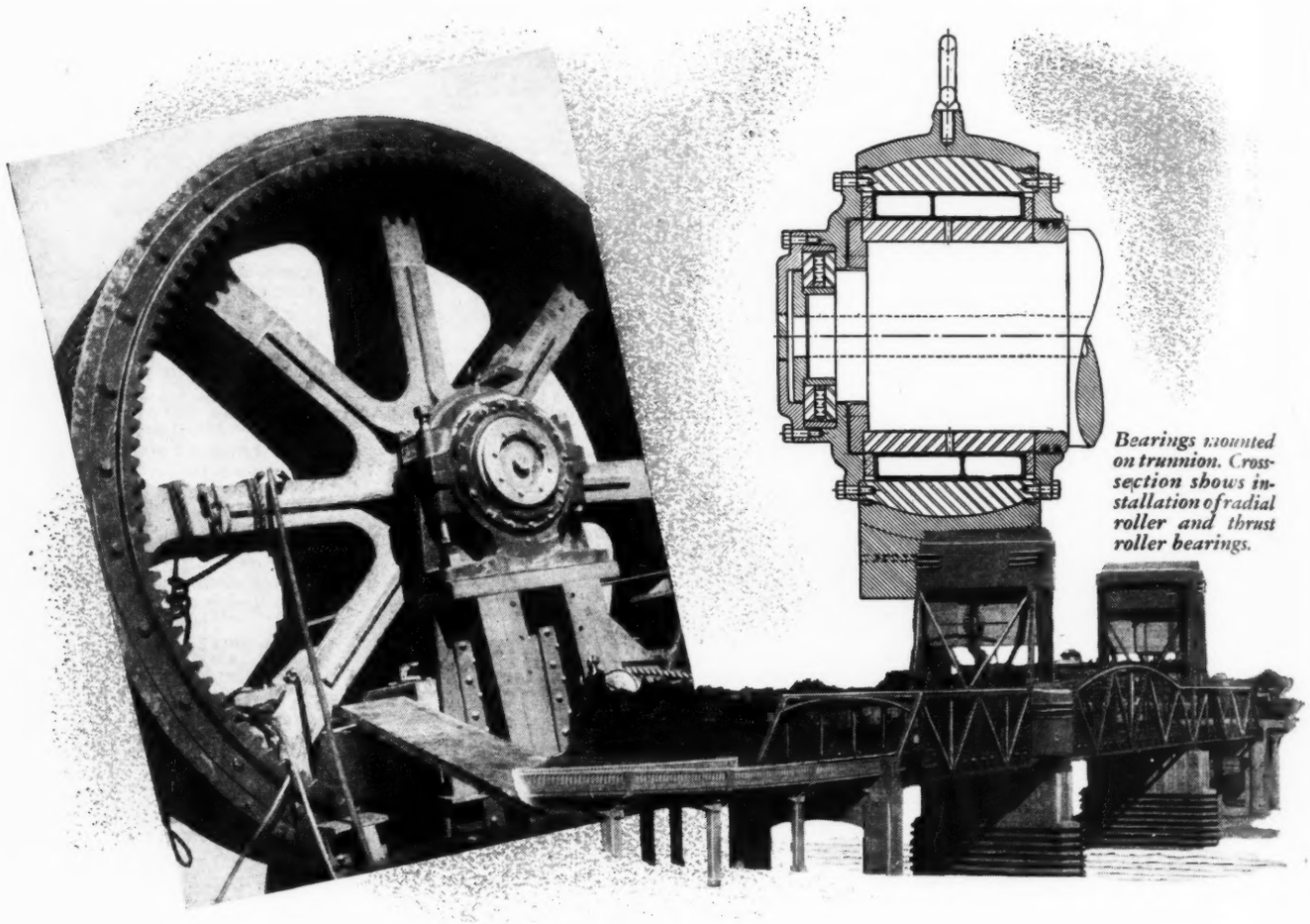

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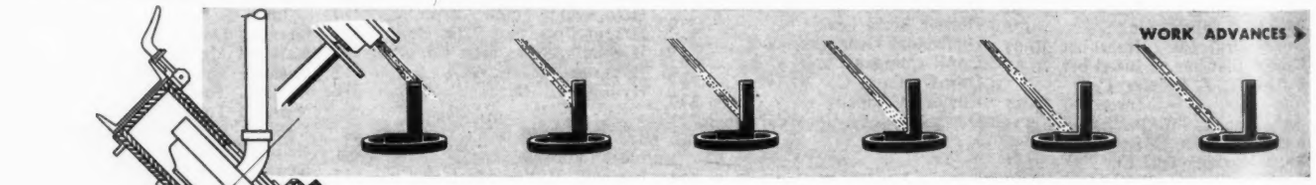

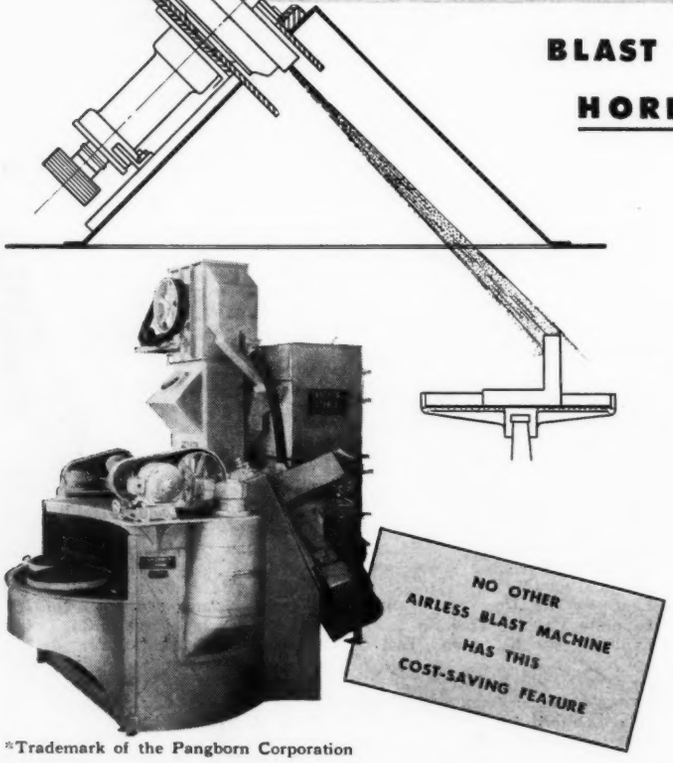

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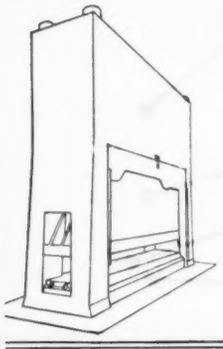

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